DATAMATION

61

November

Theodore Friedman, Computer Des Enc
Technical Research Group Inc
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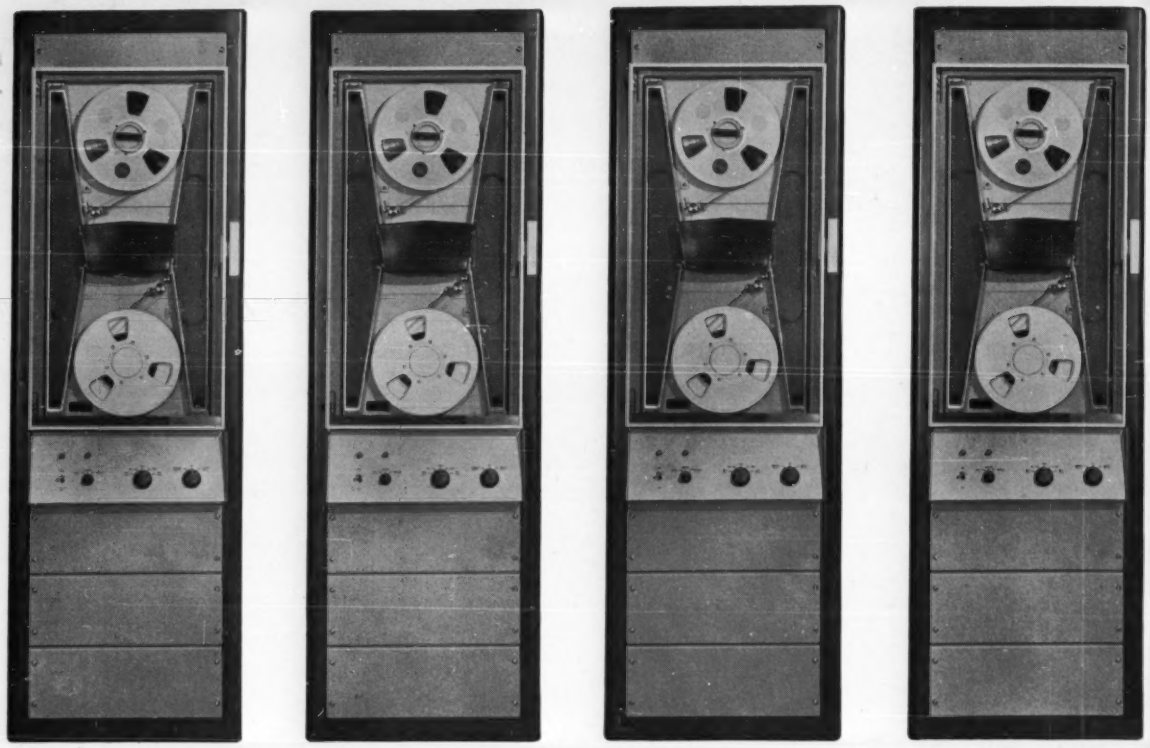

ON & ON & ON & ON

That's the way it goes ("it" being the Ampex TM-2 digital tape handler). On and on, with hardly a pause for maintenance. Completely new servo and tape guide systems give the TM-2 extremely long term performance stability. Improved vacuum buffer columns gently hold the tape supply and take-up loops. Specially developed inertia brakes give reliable stop times and short stop distances at high tape speeds. Start time of 2.0 ms and stop time of 1.5 ms are consistent under the most rigorous programs. And the TM-2 has a 90 Kilocycle character transfer rate. Why not send for all the facts: Ampex Computer Products Company, P.O. Box 329, Culver City, California.

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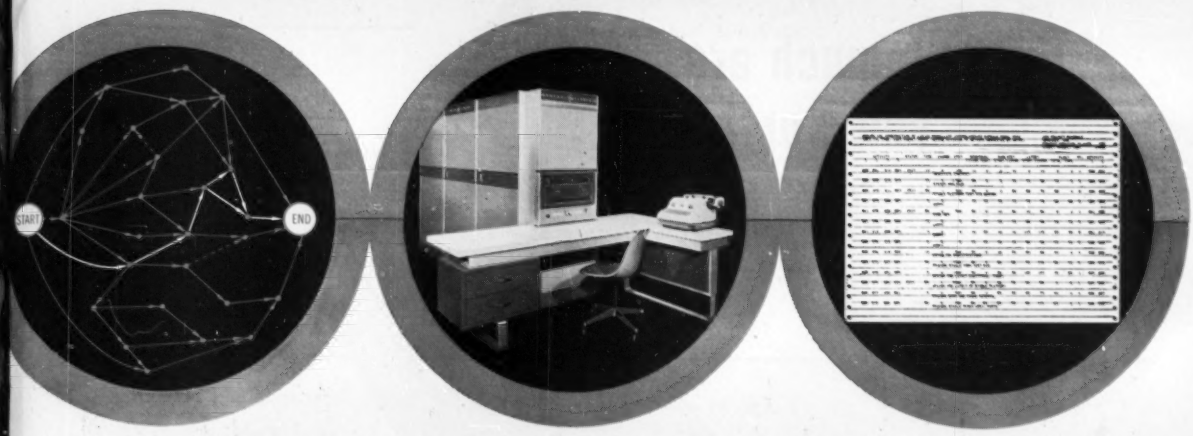

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• The application of the GE 225 to CPM represents one of many new advances pioneered by General Electric. It would be a wise move for you to investigate the benefits of the Critical Path Method, GECOM and other General Electric advances—all available for the GE 225. GECOM is the General Compiler which processes English language statements (COBOL), Algebraic expressions (ALGOL), Structured decision tables (TABSOL) and the File and Report Information Processing Generators (FRINGE).

For more information, write to General Electric Company, Computer Department, Section 65J11, Phoenix, Arizona, or contact your nearest General Electric Computer Department district office listed below.

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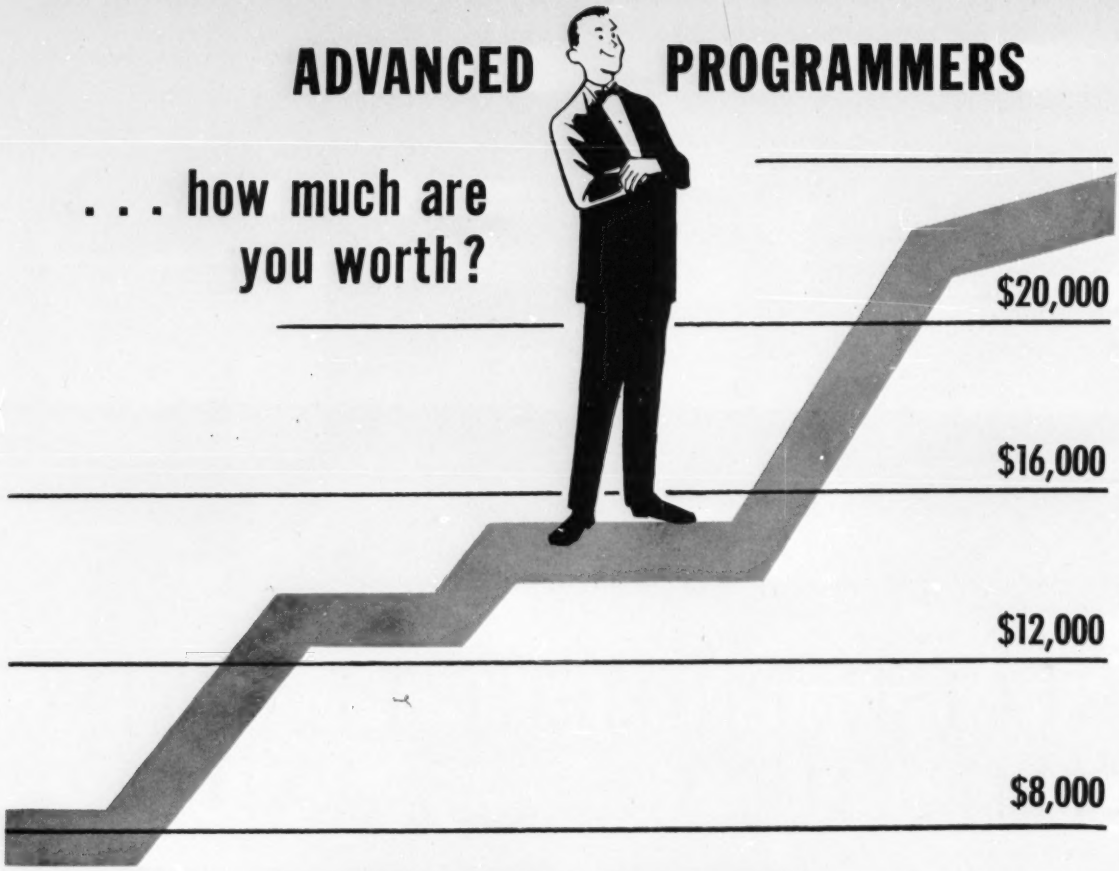

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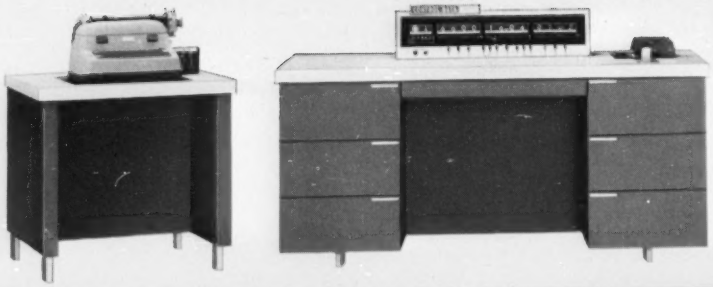
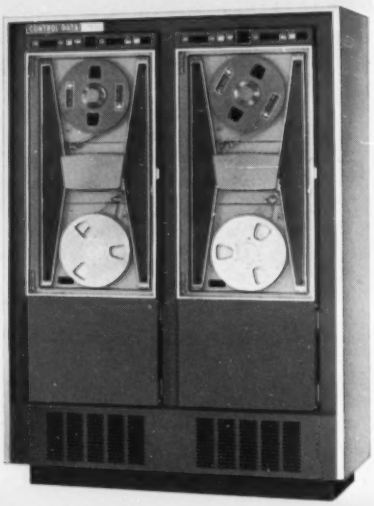
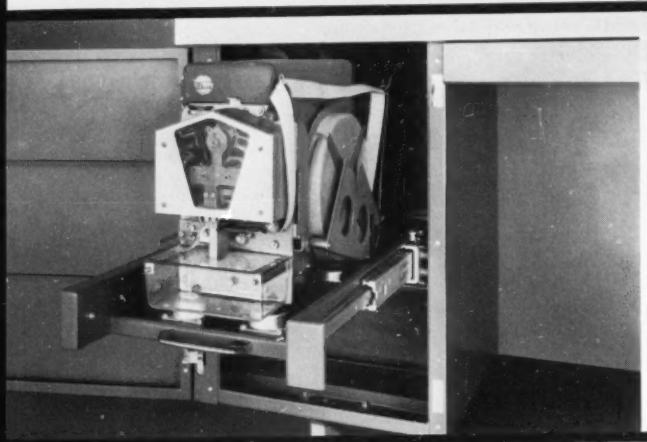
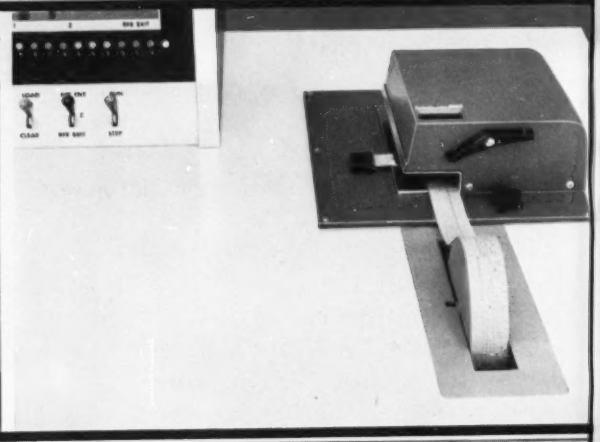
NEW CONTROL DATA

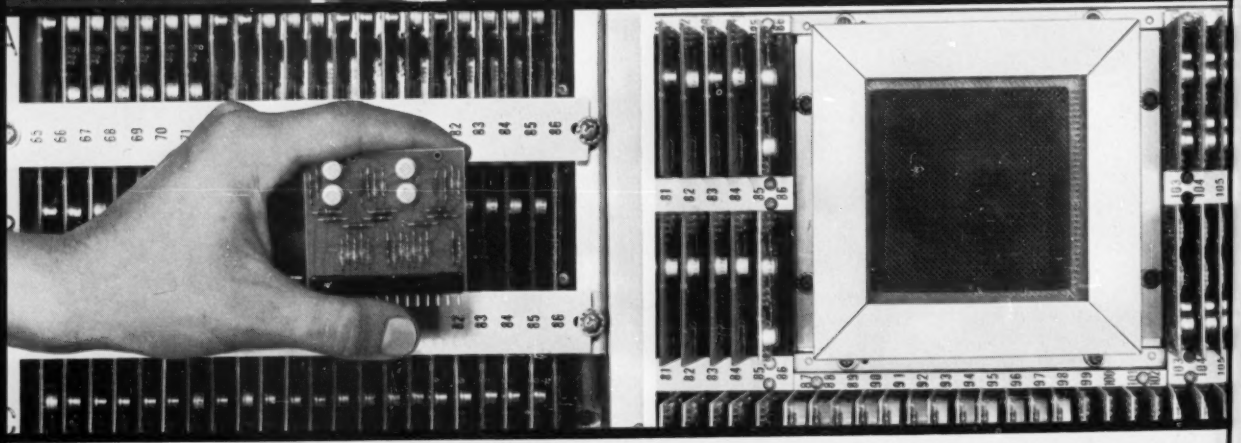
Technical Information Series #1
The 160-A Computer











160-A COMPUTER

SMALL-SCALE COMPUTER WITH LARGE COMPUTER CAPABILITIES

The 160-A is a parallel, single address data processor. Basic memory consists of two banks of magnetic core storage, each with a capacity of 4096 words and a **storage cycle time of 6.4 microseconds.** This basic memory can be expanded in modules of 8192 words up to a maximum of 32,768 words.

Instructions with 12-bit operands are executed in one to four storage cycles, with execution time varying between 6.4 and 25.6 microseconds. Average program execution time is approximately 15 microseconds per instruction.

Other features of the 160-A Computer include:

- **Buffered** input/output
- Internal and external **interrupt**
- External **multiply and divide unit**
- Control Data 350 Paper Tape Reader
- 110-character/second paper tape punch

The 160-A weighs 810 pounds and is 61⅝" long by 30" wide by 29" high . . . the size of an ordinary office desk. It requires 16 amps, 110 volt, 60 cycles.

A basic 160-A Computer System can be expanded to include the following external equipment:

- Up to 40 magnetic tape handlers
- Input/output typewriters
- Punched card readers and punches
- Low-speed line printers (150 lines/minute)
- High-speed line printers (1000 lines/minute)
- Plotting and digital display devices
- Analog-to-digital and digital-to-analog converters

TYPICAL APPLICATION AREAS FOR THE 160-A COMPUTER

The 160-A is a general purpose computer and can be used in an almost unlimited number of applications including:

REAL-TIME APPLICATIONS

The 160-A exchanges data with input-output devices at any rate up to 70,000 words per second. This transfer rate, an average instruction execution time of 15 microseconds, and the capability of buffering data while computing or while the operator manually enters data (whether the computer program is running or stopped) make the 160-A ideal for real-time applications.

OFF-LINE DATA CONVERSION

The 160-A is capable of controlling a variety of off-line peripheral equipment. Available service routines permit: 1) card-to-magnetic tape, 2) magnetic tape-to-card, 3) paper tape-to-magnetic tape, 4) magnetic tape-to-paper tape, 5) magnetic tape-to-printer, and 6) plotter output operations.

COMMERCIAL DATA PROCESSING

Along with the capability of buffering input-output devices, the 160-A Computer system includes accessories for reading 1300 cards per minute, printing 1000 lines per minute, or filing 30,000 characters per second.

DATA ACQUISITION AND REDUCTION

The input-output circuitry in the 160-A Computer permits direct communication with analog-to-digital conversion equipment. Following transmission, the data can be converted, reduced, or formated by a stored program and written on magnetic tape for later analysis if desired.

ENGINEERING-SCIENTIFIC PROBLEM SOLVING

The high-speed, buffering, and interrupt features of the 160-A make it exceptionally useful in engineering-scientific applications.

COMMUNICATIONS AND TELEMETERING SYSTEMS

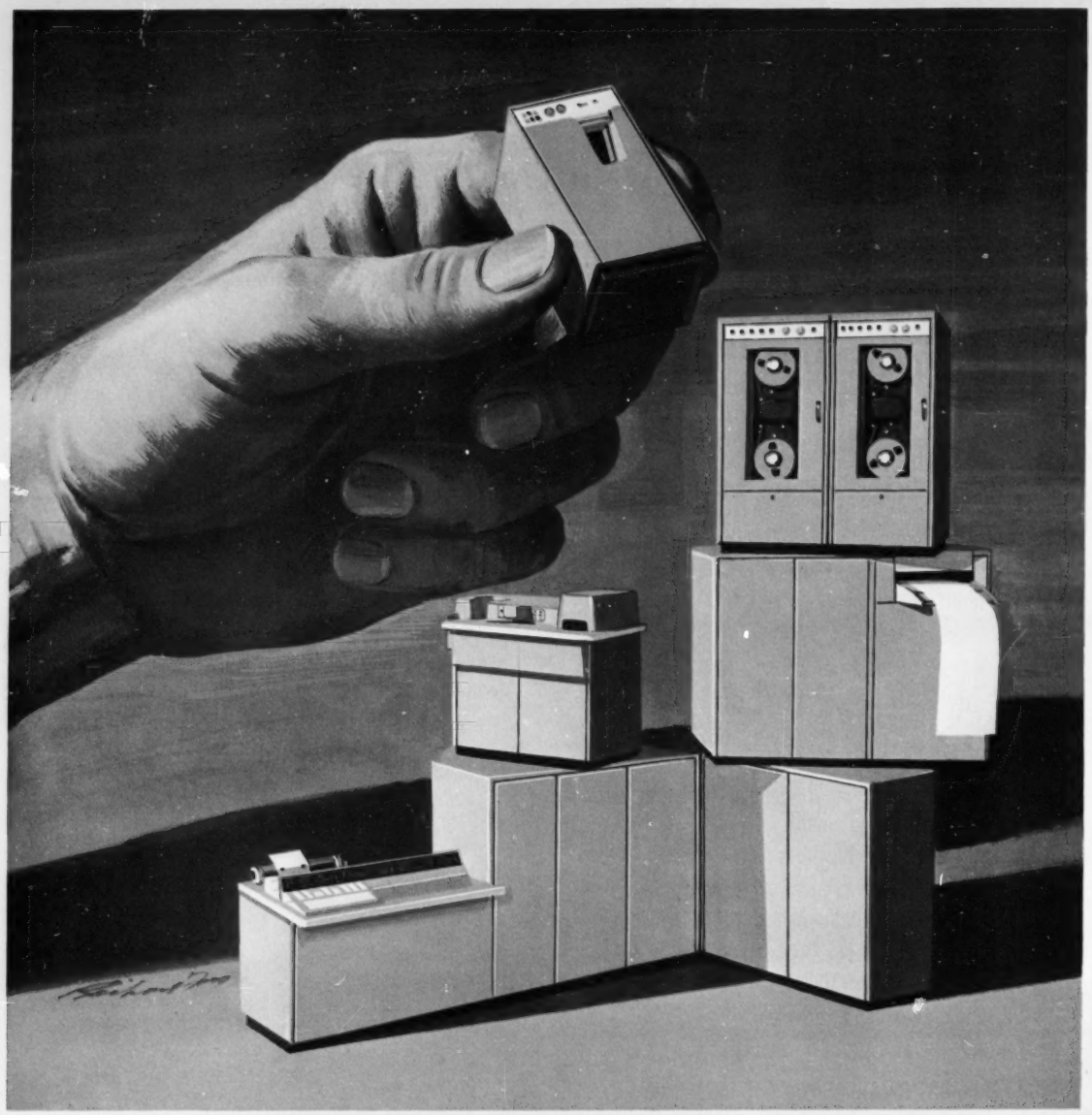
The 160-A Computer, used as a high-speed, parallel processor with decision-making powers, can be the principle element in communication and control networks. Proven reliability of the 160-A is a prerequisite for such application.

CONTROL DATA SATELLITE COMPUTER SYSTEM

The desk-size 160-A Computer is an integral part of the Control Data Satellite Computer System. Working with the large-scale 1604 Computer and the 1607 Magnetic Tape Sub-System, the 160-A presents a new dimension of computer power added to its own speed and versatility.

The Control Data 160-A is a small-scale computer with the speed, capability, and flexibility of many large-scale computers. For more detailed information, write for the **160-A Programming Manual.**

CONTROL DATA CORPORATION
COMPUTER DIVISION
501 PARK AVENUE, MINNEAPOLIS 15, MINNESOTA



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Demand for the National 315 Electronic Data Processing System has brought about rapid expansion at National's Electronics Division. In less than two years the Division's facilities in Southern California have tripled in size.

Because its major activity is development of systems for established commercial markets in 120 countries, the Electronics Division is advancing on exceptionally solid ground. These vast markets, served by National's Marketing Division, point to excellent career stability for the men who create the systems.

If you qualify for one of the new openings, you will experience constant technological challenge and continuous opportunity for personal growth. You will also enjoy discovering that Southern California provides year-round opportunities for recreational and cultural activities.

PLEASE SUBMIT RESUME IMMEDIATELY TO ARRANGE FOR INTERVIEW DURING EASTERN JOINT COMPUTER CONFERENCE IN WASHINGTON. Write to Norval E. Powell, Personnel Manager, at the address below.

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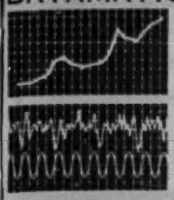
CIRCLE 75 ON READER CARD

DATAMATION



BUSINESS & SCIENCE

UNIVAC: A SOBER LOOK BACK & A PEAK AHEAD

Timing their celebration of the 15th anniversary of Eckert & Mauchly's ENIAC with the opening of a $20-million Whitpain engineering center, the UNIVAC division of RemRand last month illustrated its intentions of regaining some of its enormous losses in prestige and profit from a formidable Poughkeepsie neighbor.

In number of computer installations, UNIVAC presently claims an overly high 14 per cent of the 5-6,000 total in the industry (currently rated as a $1-billion market). RemRand president Dause L. Bibby predicts that by 1965 the market will triple with approximately 10-15,000 computers and that UNIVAC's share will also climb in rough proportion to the industry's growth.

This optimism was not always prevalent in the company as Bibby explained that when UNIVAC I was first announced a decade ago, it was predicted that the total market potential for computers was six machines.

By the end of '61 RemRand will have 400 80 and 90s installed and there are presently 200 additional orders in the house. The third generation 1107 is reputed to have 12 orders on tap with one of the first deliveries scheduled for Computer Sciences in the Fall of '62. However, continuing sales of the thin film computer will remain thin indeed if compatibility with the 7090 is not forthcoming.

Increased emphasis on low cost peripheral gear was one of the trends predicted for RemRand at the Whitpain opening with the announcement of Unicall, a computer inquiry, voice reply device renting at $30 per month. A sale announcement of 2,100 Unicalls to various airlines to assist in real time control is expected shortly.

Increased attention to software was notable at the anniversary celebration. Both Mauchly and Bibby pointed to the urgency and importance of application studies and programming to the future of computing. Bibby stated that out of 1,000 hours devoted to the design and manufacture of hardware, about one hour is used for application work. Indicative of a major change in UNIVAC direction in software was the announcement of Grace Hopper's transfer to the University of Pennsylvania where she will center her programming efforts on a UNIVAC I and newly donated solid state 80.

RCA's HIGH COST OF PATIENCE

Not untypical of most of its brethren in the computing field, RCA's edp losses have been continually outstanding. At present a total employment of over 1,800 including a field force of 800 and an alleged 190 programmers comprise the company's obviously well-financed edp division. Despite this fact, reported installations are well below management expectations. By the end of this year there will be 80 501s and 50 301s installed and 50 601s by mid-1962. Signed late last month was the first 604 contract (a 601 with highspeed tapes) for delivery next year to Cal Tech.

While RCA management expects an upward trend, their time table for turning the corner is as yet undefined. Present plans may include some new systems next year (possibly third generation) but no successor to the 501 and no STRETCH-class giant. The 301 is due for a new line of peripheral gear designed by Bull in France.

The RCA sales approach has thus far centered on the controller largely ignoring the more sophisticated user. No changes in this emphasis have been indicated despite a recent survey conducted by an independent agency for RCA which concluded that technical management (as opposed to accountant-types) are exercising major influence in a decision to purchase computing power.

Nevertheless, it is expected that a profit will be made by RCA (and others) by the sheer weight of the dramatic increases occurring and forthcoming in the computer market (see news item on the 1401) and despite all efforts by the manufacturer to maintain a normal loss picture.

THE 1401: WORLD'S LARGEST BACKLOG

With the 1,000th 1401 having rolled off IBM's production line over a month ago, an enormous backlog of more than 5,000 domestic orders and 1,000 for foreign delivery will result in a doubling of the total number of the world's computers within a year. Add to this total an additional 1,000 1410 systems presently on order and it becomes apparent that whatever privation IBMers have undergone, they cannot be attributed to a lack of business.

CDC's UNIQUE PROFIT MOTIVE

A peculiar exception in the computing business is CDC's intention and ability at producing continuing profits. At present there are 72 installations of the 160A and 160 with 50 orders in house. By the end of

this year there will have been 25 installations of the large scale 1604. Another lip-smacking statistic: when CDC began its operation in July, 1957, their total cash assets were $19,000. This year their sales should climb well in excess of $25-million.

PALEVSKY FORMS NEW COMPUTER FIRM

After departing suddenly from Packard Bell Computer last July, veteran computerite Max Palevsky has proceeded to finance and organize a new contender for the small scale, gp, scientific computer market: Scientific Data Systems, located in Santa Monica, Calif.

Well-known from his early days with Bendix Computer and during the past four years with Packard Bell, Palevsky was the motivating force behind the PB 250. Recruited from Packard Bell as vice president for engineering is Robert Mark Beck, who had been instrumental in the logical design of the 250.

Chairman of the board for SDS is Albert Sperry, former head of Information Systems Inc., and as chief of the SDS computer group, Henry Herrold was obtained from Hughes.

The new company is privately and substantially financed, presently has 20 employees, occupies 11,000 sq. ft. and expects to undertake "a more ambitious program" than was pursued at PB. The first system will be announced sometime next year.

HONEYWELL REPORTS ON FACT

Detailing progress on its much-discussed FACT compiler, Honeywell has issued the following invitation to computer consultants:

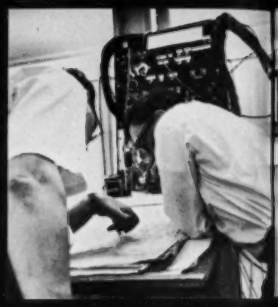
> "As a token of confidence in the state of readiness of FACT, we take pleasure in inviting you or a member of your staff to visit our Wellesley headquarters . . . to take a short course in FACT programming, to write your own FACT program and have it compiled and operated on the Honeywell 800."

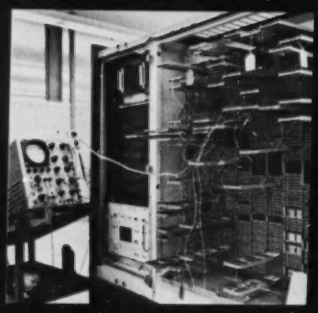
As for the specifics of delivery, Honeywell has stated that FACT tapes were delivered late last month to 800 customers "for systems test purposes," and that additional FACT tapes will be released in November and December to supplement the present version.

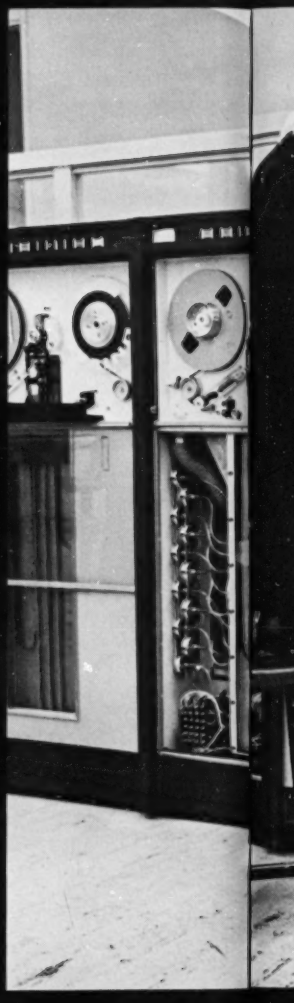
At this time, Honeywell adds that FACT is compiling object programs for the 800 and "is under test on an around-the-clock basis on three 800 systems at EDP headquarters in Wellesley.

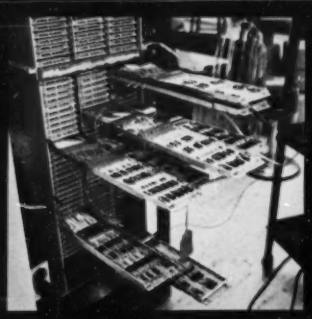
Two 800s will be installed by the Australian department of defense in Camberra next summer. Honeywell states, "A major factor in their decision was the FACT compiler."

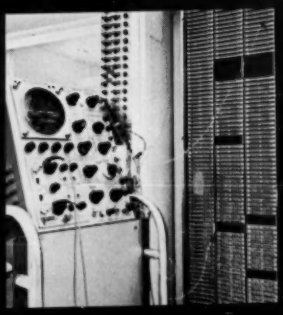
Twenty-five 800s have been installed by the company as of last month.

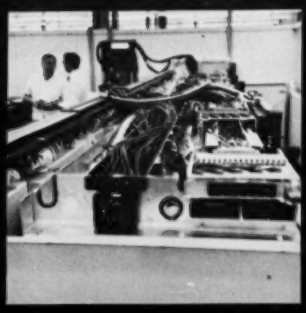




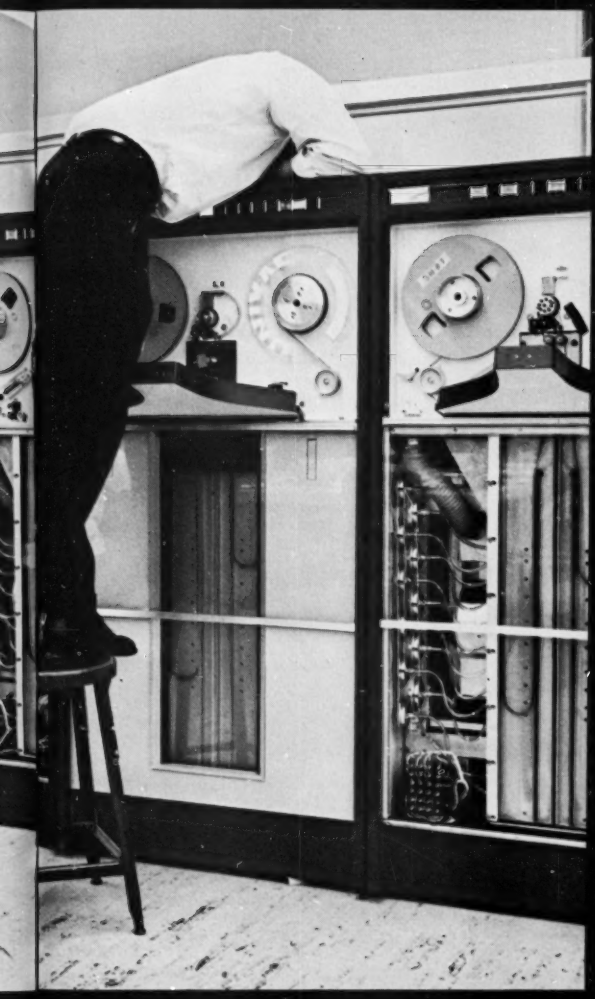








Univac in action...



Countdown on Univac III—the world's most powerful large-scale business computer

This is UNIVAC® III. In November 1961, this new computer completes systems test and goes "on the air" as an operating system—ahead of schedule. *Ahead of schedule* because of automated development techniques* perfected by Univac.

UNIVAC III provides more output at lower unit cost than any other system available today. Renting from $18,000 to $22,000 a month, it delivers more power than computers in the $30,000 to $40,000 class!

Its central processor contains enough main memory storage for a program of up to 32,768 commands. And it takes only 4 microseconds—one million times faster than you can read this sentence—to complete a computer cycle. Add time? 8 microseconds.

Need mass storage for large-scale batch data processing? Up to 32 new Uniservo III tape units can be used to meet your requirements. A new character packing technique permits you to store 48 million digits on a single reel of tape—over a billion and a half digits in all.

Looking for speed? This new Uniservo III tape can be read and written at the rate of 200,000 digits per second. Fully modular, UNIVAC III can handle four of these tapes concurrently—*800,000 digits per second.*

Want easier operation? With UNIVAC III, there's a minimum of operator intervention, a minimum of tape change-over. For example, you can read, write, and compute concurrently with up to 8 different input-output operations. A unique multiple program-interrupt feature assures their compatibility.

UNIVAC III also provides "open-end design." Its 8 general-purpose, bi-directional channels can accommodate any new or improved peripheral equipment, on-line or off. They won't compete with the computer.

You get simplified programming, too. A variety of automatic coding techniques is available to suit your needs.

A continuation in design concept of the incomparable LARC computer, UNIVAC III brings you economy and flexibility, accurate performance and high computing speeds. Because of this advanced logical design, UNIVAC III memory can be made to handle bigger jobs if your future needs require it. You just add the necessary memory module.

Only with UNIVAC III will you find all these advantages combined in a single system. Why not call your Univac representative for full details?

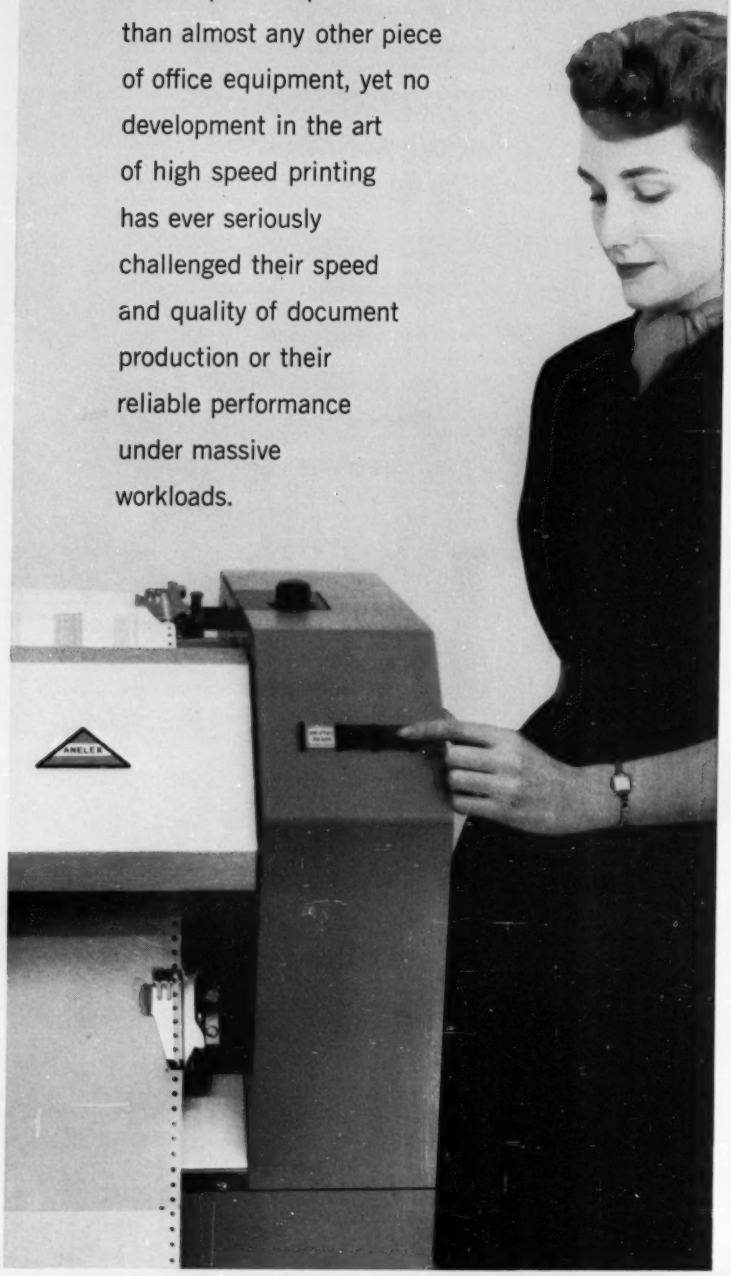
*UNIVAC I was used to design, test and prepare all diagnostic programs as well as for backboard wiring layouts during development of UNIVAC III. Software and hardware were produced simultaneously . . . a major factor in the accelerated schedule of this powerful new computer.

UNIVAC

DIVISION OF SPERRY RAND CORPORATION

ANELEX®

Anelex High Speed Line Printers are simpler to operate than almost any other piece of office equipment, yet no development in the art of high speed printing has ever seriously challenged their speed and quality of document production or their reliable performance under massive workloads.



ANELEX

Further information available upon request

ANELEX CORPORATION

154 Causeway Street, Boston 14, Massachusetts

CIRCLE 7 ON READER CARD

important DATES

• An ACM Technical Symposium sponsored by the Los Angeles, Orange County and San Fernando Valley Chapters of ACM will be held on Nov. 21 at the Miramar Hotel, Santa Monica, Calif.

• The Joint Users Group (JUG) will hold its next meeting on Dec. 11th at the Sheraton Park Hotel, Washington, D.C. Ratification of membership of participating groups is expected.

• The 1961 Eastern Joint Computer Conference is set for Dec. 12-14 at the Sheraton Park Hotel, Washington, D.C. Theme of the Conference is "Computers – Key to Total Systems Control." See pages 55-70.

• The second in a series of two forums on legal questions raised by computer use in business, industry and government is being sponsored by the Joint Committee on Continuing Legal Education of the American Law Institute and American Bar Assoc., to be held Dec. 14-16 at the Statler-Hilton Hotel, Los Angeles.

• A symposium on Optical Character Recognition is scheduled for Jan. 15-17 jointly sponsored by the Information Systems Branch of the Office of Naval Research and the Research Information Center of the Bureau of Standards. Meetings will be held in the Dept. of Interior Auditorium, Washington, D.C.

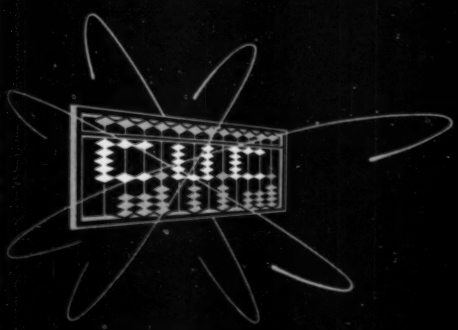
• The Office of Naval Research, Information Systems Branch, is sponsoring a symposium on Redundancy Techniques for Computing Systems which will be held on Feb. 6-7 in the Dept. of Interior Auditorium, Washington, D.C.

• The Spring Joint Computer Conference (formerly known as the Western Joint Computer Conference) will be held May 1-3 at the Fairmont Hotel, San Francisco. Conference chairman is G. A. Barnard, Philco Corp,. Palo Alto; vice chairman is H. D. Crane, Stanford Research Institute, Palo Alto and program chairman is R. I. Tanaka, Lockheed Corp., Palo Alto.

• The 1962 IFIPS Congress is scheduled for Aug. 27-Sept. 1 in Munich, Germany. For information write to Dr. E. L. Harder, Westinghouse Electric Corp., East Pittsburgh, Penna.

A SINGULAR OPPORTUNITY FOR EDPM PROGRAMMERS

is offered by Computer Usage Company to professionally qualified individuals. Experience is required in programming and systems analysis for applications in . . . **Commercial Data Processing, Scientific and Technical Problems, Automatic Programming Systems.** CUC, working with over eighty-five of the nation's leading organizations, has completed over 700 successful sets of programs. Our growth, from a staff of six people in 1955 to over a hundred in 1961, has been limited only by the rate at which truly capable new staff members can be individually assimilated. ■ Your inquiries, which will be treated in complete confidence, may be addressed to any of our offices.



CIRCLE 82 ON READER CARD

COMPUTER USAGE COMPANY, INC.

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Mr. Robert H. Glaser . . . . . 18 East 41st Street

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Mr. Walter B. Nelson . . . . . 1825 Connecticut Ave.

LOS ANGELES
Mr. George J. Vosatka . . . . 6266 Manchester Blvd.

All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

Honeywell EDP Presents:

A FEW QUICK FACTS ON SOFTWARE

Software is a new and important addition to the jargon of computer users and builders. It refers to the automatic programming aids that simplify the task of telling the computer "hardware" how to do its job. The importance of software lies in the fact that programming a computer can be an arduous, time-consuming and costly operation and the quality of automatic programming aids has become virtually as important as equipment specifications in evaluating the total capability of a data processing system.

Generally, there are three basic categories of software: 1) Assembly Systems, 2) Compiler Systems, and 3) Operation Systems.

Assembly Systems

The basic element of any assembly system is a programming language that uses simple, easy-to-remember codes or terms to represent the various machine instructions. Code names are also used to represent entire fields of information stored in the computer memory. Under control of an assembly program, the computer translates these terms into the appropriate machine-language instructions.

Most good assembly systems include an extensive library of re-usable routines that can be combined into a group or inserted as part of a program by a computer. This way, routines for repetitive functions do not have to be re-written each time they are required. A sophisticated assembly program also includes routine generators that require only definitive parameter information to yield detailed sorting routines and input or output editing routines. Assembly systems also include routines for housekeeping functions such as controlling end-of-file conditions and the flow of data to and from the computer memory, tape-labeling to check and update the identifying information recorded on every magnetic tape, and other controls as opposed to data processing functions.

Compilers

Compiler systems differ from assembly systems in that they translate from a source-language into a machine-orientated language. The source-language of a compiler is based on the nature of the work to be done — business terms for business compilers, mathematical terms for scientific compilers — rather than on symbolic machine-language. When a problem stated in compiler (or source) language is fed into the computer, the compiler program translates the source-language program into detailed machine-language or asembly-language instructions that tell the computer how to carry out the desired work.

Compilers vary widely in sophistication and usefulness. The more advanced types produce programs with as little as 1–10th of the human effort required using an assembly system, or 1–100th of the effort that manual machine programming would require. Because so much of the detailed work is done by the computer, there are fewer opportunities for logical or human errors. Programs written in compiler language are easily read and evaluated by supervisors or others with an interest in the details of the computer application.

An added plus is the fact that the programs in this form provide readable documentation, including the latest changes, of the data processing procedures.

An advanced compiler can generate sorting routines, create files, generate printed reports, and edit and check data. If compilers do not have all these capabilities, the gaps have to be filled in using assembly-or machine-language. Obviously this dilutes much of the original value of the compiler.

Operation Systems

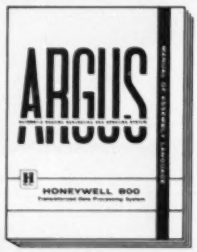
The terms assembly and compiler systems pertain principally to the language in which a program is written and the means of translating this language into machine-language programs. In addition to these systems are systems for monitoring the operation of the machine-language program and for operating these programs in varying modes. For example:

Program diagnostic systems may help make good use of computer time by permitting "batch" checkout without human intervention. Special outputs can be tailored to the programmers' needs to tell them what they want to know about their programs. This testing technique can speed program checkout by enormous factors.

Simulator Programs can be written to make one computer act like another. During conversion periods, for example, programs written originally for an outmoded computer can be run directly on the new computer with a simulator program. This permits immediate operation on the new system without reprogramming, and new programs, designed to utilize the capabilities of the new computer with maximum efficiency, can be written unhurriedly.

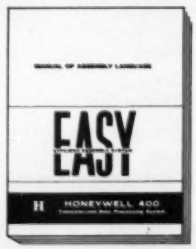
Monitor routines increase the efficient utilization of equipment by controlling the selection and sequencing, starting and stopping of programs, and thereby removing much of this detail from the duties of the computer operator.

With every electronic data processing system, Honeywell provides an unusually complete and powerful package of automatic programming aids. Here are some of the Honeywell innovations in in above three areas.



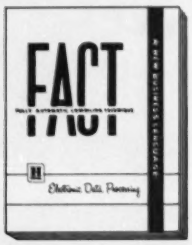
Honeywell ARGUS

An assembly program for the Honeywell 800, called ARGUS, includes an easy-to-use assembly language, a library of routines and generators, and all the operational programs that simplify program writing, reduce errors, and keep the need for human intervention to a minimum, thus utilizing the computer in the most efficient manner. There are versions of ARGUS for both punched-card and magnetic-tape systems.



Honeywell EASY

EASY is the name of the assembly system for the Honeywell 400. EASY includes all the elements of a powerful assembly system including powerful editing instructions for input and output operations and the ability to incorporate thoroughly tested routines into a program. Programs written in EASY language can be checked out and run on Honeywell 800 as well as Honeywell 400 systems.



Honeywell FACT

An advanced business compiler for the Honeywell 800, called FACT, is the acknowledged leader in its field. It is the first compiler to take into account all facets of data processing including editing input information, sorting, creating files, processing variable-length records and generating output reports. Due to the exceptional breadth and power of FACT, an unprecedented percentage of business operations can be programmed for a Honeywell 800 with this system — and in a fraction of the time previously required.

Honeywell Algebraic Compiler

This Honeywell compiler aids the creation of scientific and mathematical programs. The programming language is the same basic terminology used by several computer manufacturers and the sub-routine library consists of routines commonly used in solving scientific and engineering problems. Algebraic compilers are being offered for Honeywell 400 and Honeywell 800 data processing systems.

Honeywell COBOL

Considerable effort has been expended by the computer industry in an attempt to develop a universal problem-oriented programming language that can be implemented for all computers. One such business-language compiler is called COBOL (Common Business-Oriented Language). Facilities are being provided in both Honeywell 400 and 800 for accepting programs written in COBOL language.

Honeywell Executive System

Maximum use of the ability of Honeywell 800 to run programs in parallel is achieved through an automatic programming aid called Executive System. The executive system assists the human planner in preparing and executing a daily production schedule which optimizes utilization of the system's available equipment configuration and parallel processing ability. It controls program loading, turning on and off of programs, provides restart facilities in case of program failure or operator error and communicates with the operator, keeping him informed of progress of the run, and accepting his control instructions in case the schedule has to be modified at production time.

Honeywell Program Test System

Efficient machine utilization is the primary benefit of the Program Test System which permits programs to be batched and tested at high computer speeds without human intervention. Programmers receive whatever output information they require to evaluate their efforts and make necessary changes and improvements.

Honeywell Library Addition and Maintenance Program

The utility of a library of re-usable routines is directly dependent on the extent of provisions for adding, deleting or merely selecting routines for use. A special Honeywell program called LAMP handles these functions automatically.

Honeywell Scientific Routines

An important part of the library of routines furnished by Honeywell are the various scientific programs for computing trigonometric functions, exponentials, logarithms and other transcendental functions; performing matrix multiplication and matrix inversion, interpolation curve fitting, solving ordinary differential equations, linear programming problems and others.

Sort and Collate

A unique series of sort generators have been designed for use with Honeywell data processing systems. These generators require only basic parameters to develop sorting or collating routines utilizing special advanced sorting techniques developed by Honeywell specialists. These new techniques take advantage of the high-speeds and multiple-duty capabilities of Honeywell EDP systems and result in exceptionally high-speed sorting.

THOR

To minimize the amount of manual tape-handling procedures necessary in the operation of Honeywell 800 systems, a special routine called THOR has been devised. Under the direction of operator-devised parameters, THOR handles all tape positioning, copying, correcting, and editing of recorded information. THOR also helps locate information on tape, compares the contents of two tapes for discrepancies, and performs general tape maintenance.

Simulator Systems

Among the extensive Honeywell automatic programming aids available are simulator programs that facilitate changeover from outmoded systems to Honeywell systems. These simulators enable programs written for other computers to be run directly on a Honeywell 800 without modification, often at speeds as much as four times faster than on the original system.

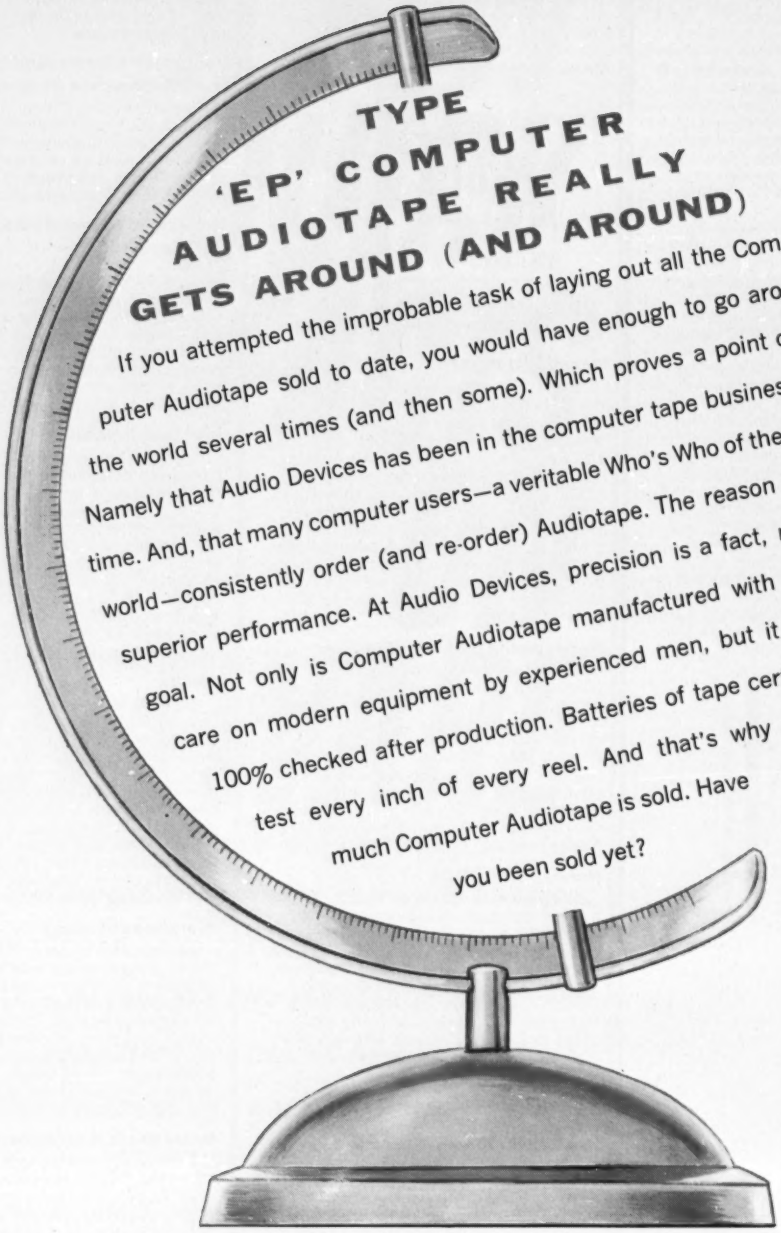
Want More Information?

For more hard facts on Honeywell "Software" (and hardware, too), contact your nearest branch office or write Honeywell EDP, Wellesley Hills 81, Massachusetts. In Canada, Honeywell Controls Limited, Toronto 17, Ontario.

Honeywell

Electronic Data Processing

CIRCLE 9 ON READER CARD

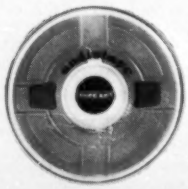


TYPE 'EP' COMPUTER AUDIOTAPE REALLY GETS AROUND (AND AROUND)

If you attempted the improbable task of laying out all the Computer Audiotape sold to date, you would have enough to go around the world several times (and then some). Which proves a point or two. Namely that Audio Devices has been in the computer tape business a long time. And, that many computer users—a veritable Who's Who of the business world—consistently order (and re-order) Audiotape. The reason is simple: superior performance. At Audio Devices, precision is a fact, not just a goal. Not only is Computer Audiotape manufactured with extreme care on modern equipment by experienced men, but it is also 100% checked after production. Batteries of tape certifiers test every inch of every reel. And that's why so much Computer Audiotape is sold. Have you been sold yet?

For complete information and specifications on Computer Audiotape, the extra precision tape, write to Dept. D:

AUDIO DEVICES INC. 444 MADISON AVE. NEW YORK 22, N. Y.



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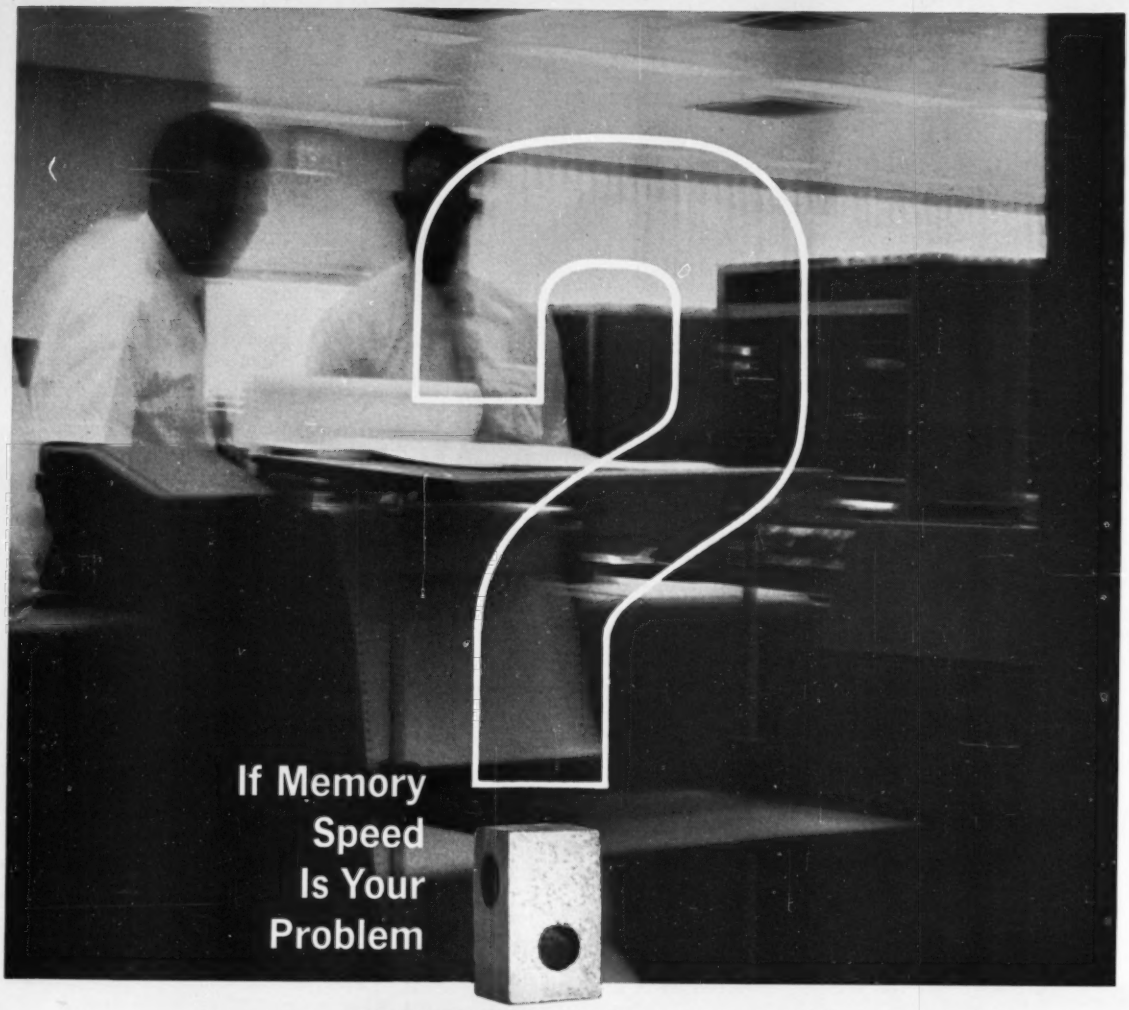

The answer is BIAX highest-speed instruction memory now in production

Aeronutronic is now delivering production BIAX memories in word capacities ranging from 128 to 1024 as a standard line. BIAX memories operate at high speed, with non-destructive read, low power and high reliability.

BIAX memories are recommended for high speed programs or fixed statistical storage; where non-destructive memory is required; in industrial or process control and for fixed programs for automatic check-out equipment.

BIAX memories can be built into systems for read-write memories, and custom units—larger or smaller—can be manufactured to your individual requirements and designed for severe environmental conditions.

Low power requirements plus high reliability over a broad range of environmental conditions assure dependable performance.

For additional information regarding prices, delivery and application to your needs, contact: BIAX, Dept. MT.

SPECIFICATIONS: Up to 1024 words; up to 36 bits per word; read cycle time: 1.0 μ second; access time: 0.4 μ second or faster; loading: from manual up to 200 kc; power: less than 50 watts; temperature: 0°C to 50°C.

Ford AERONUTRONIC
NEWPORT BEACH, CALIFORNIA

See the BIAX Exhibit at the Eastern Joint Computer Conference, booths C-19 and C-20, Sheraton-Park Hotel, Washington, D. C., Dec. 12-14.

CIRCLE 11 ON READER CARD

WRITE AT -30°C, READ AT +90°C W/O COMPENSATION

MEMORY

Electronic Memories, Inc., makes it: A pocket-size 1440-bit core memory for missile environments and space operation.

Tried to design a satellite memory lately? It's tough. Especially when you want an operating power requirement of 300 mw at 1 kc with a standby requirement of 2-3 mw. You've also got a stringent reliability goal, so you hold the use of semiconductors to an absolute minimum.

But the real problem is temperature. Especially when you want to be able to write at +90°C and read 120° further down the scale. You can do it with oil baths, ovens, special circuits, and pseudo-science. But the right way is without compensation in the drive circuits or stabilization of magnetics. And don't forget about size: the whole works must fit a 30 cubic inch package.

Impossible? No. Want proof? Easy. See the above unit, live, on scope, at Booth B9B, EJCC. Or write today for further data.

electronic memories inc.

9430 Bellanca Avenue • Los Angeles 45, California

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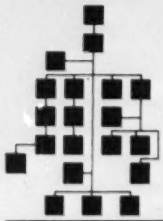


people IN DATAMATION

■ Robert S. Baker has been appointed manager of the Huntsville, Ala. Computer Center for G.E.'s Computer Department. Baker, former manager of intermediate systems at Computer Department headquarters in Phoenix, will now be responsible for overall operations of the Center.

■ Professor Howard H. Aiken, director of the computation laboratory at Harvard University, has retired from the faculty. The world's first large-scale computer, the Mark I, was designed by Aiken in collaboration with IBM in 1939. Later, he and his staff and students designed and built Mark II, Mark III and Mark IV. Aiken was a pioneer in automatic language translation, automatic shorthand transcription, and the use of magnetic cores and drums as computer components.

■ Robert W. Bemer will assume the new position of director of programming standards for IBM. Bemer, who joined IBM in 1955, will be responsible for the company's participation in programming standardization activities with industry and national associations including chairmanship of ASA's X3.4 working group on ALGOL and COBOL.

■ Dr. Aaron Finerman has accepted the post of professor of engineering and director of the computer center at the State University of New York, Long Island Center. Dr. Finerman, who was previously manager of the digital computing and dp division at Republic Aviation, also resigned as president of SHARE, since the computer center does not meet the requirements for SHARE membership.

■ Robert Glaser, formerly with the International Telephone and Telegraph Federal Laboratories, has joined Computer Usage as manager of New York operations. Another new member of CUC in New York is Irving J. Liggett, previously director of programming standards for IBM.

for the first time Showing at EJCC Booth F-9

The checklist for economical equipment compatible with your data handling systems

DASHEW BUSINESS MACHINES, INC.

MODULAR COMPONENTS PROVIDE INPUT TO OFFICE ACCOUNTING MACHINES, GENERAL PURPOSE COMPUTERS, INDUSTRIAL PROCESS CONTROL COMPUTERS, NUMERICAL MACHINE TOOL CONTROLS, TYPEWRITERS, AND DATA COLLECTION SYSTEMS. COMPONENTS CAN CONNECT TO DATAPHONE TRANSMISSION SYSTEMS, CAN BE INTEGRATED INTO INSTRUMENTATION SYSTEMS FOR GROUND CHECKOUT EQUIPMENT, EVALUATION DEVICES, MEASUREMENT SYSTEMS, ETC. NO EXPENSIVE INSTALLATIONS ARE REQUIRED FOR COUPLING THESE COMPONENTS TO OTHER EQUIPMENT TO BUILD YOUR REQUIRED SYSTEMS.

- **Punched Card Reader, Model DC-1000*** ... flexible input device for reading punched cards at speeds of 0 to 40 (pulsed), or continuous rate of 80 columns per second. Lowest-cost (less than $2,000) card reader is small, efficient and reliable.
- **Punched Tape Reader, Model DC-700*** ... general purpose tape reader with reading speed of 0 to 30 characters per second, stops on designated character on command. Capable of reading 5, 6, 7 or 8 channel tapes by star wheel sensing.

SOURCE DATA RECORDING EQUIPMENT

- **Printapunch*** ... key to error-free, automatic data recording at time of transaction. It copies, punches, eliminates transcription ... permits practical, low-cost method of source key punching ... so low in cost and so simple to operate that even a small manufacturer or retailer can gather source data directly onto tab cards to take advantage of the economies and speed of electronic service bureau facilities.
- **Source Data Recorders** ... Low cost, automatic data gathering equipment featuring: Dataphone transmission (no wiring installation problems); portable hand-held read head, cable-connected for reading punched and embossed Dashaplates attached to parts, material bins, personnel badges, or work travellers; no input delay, identification plate is instantaneously released before transmission; reads any combination of alpha and numeric data in any code format punched in Dashaplates® or 80 column cards, together with variable data from keyboard and constant data from plugboards.

SUPPORT EQUIPMENT TO PREPARE METAL OR PLASTIC DASHAPLATES FOR YOUR SYSTEM CAN BE PURCHASED OR PLATES CAN BE PREPARED IN DASHEW'S NATIONWIDE SERVICE BUREAUS.

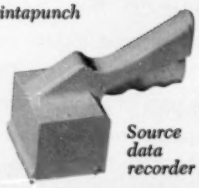
- **Datatyper 400*** ... silent, fast manual embosser and code puncher.
- **Electronic Databosser® V100EW*** ... highspeed multiple character plate embossing and punching machine, actuated by punched cards or common language tapes. Embossing speed up to 3,600 plates per hour, automatically tips.
- **Electronic ID BiCamera** ... produces instantaneous negative film combining picture of person and data which prints plastic ID Dashaplate for permanent personnel badge, identification card, license or credit card. Dashaplate ready for embossing and punching within seconds after taking picture.

* *Orders immediately accepted for delivery. Other equipment produced to order.*

Punched card reader Model DC-1000

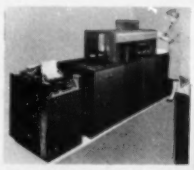
Punched tape reader Model DC-700

Printapunch



Source data recorder

Datatyper 400



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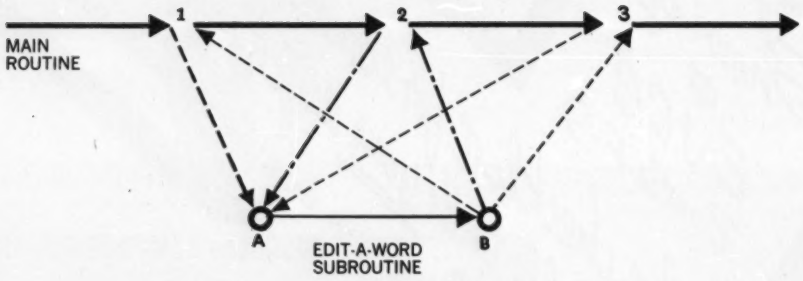

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EDITOR'S READOUT

SOFTWARE ON THE COUCH

As one of the more visible targets for recent verbal gambits, the well-publicized potentials of software have been riddled during the past few months with a barrage of generally well-aimed criticism.

The effect has been one of withdrawn embarrassment; a quiet revision of delivery schedules; a crash program to check out a compiler or two, and some judiciously phrased, user-directed pleas for compassion and patience.

In the midst of this introversion, there exist the classic conditions prompting a call for psychotherapy, albeit on a hypothetical, industry-wide basis. There is growing recognition that a problem exists; some concern that the problem must be resolved and serious confusion as to precisely what action should be taken. In this case, a favorable prognosis could be made solely on the youth of the patient and the lack of firm internal commitments.

Interpreting its history, the following influences have been instrumental (although hardly inclusive) in placing software on the couch:

During the mid-50s, the rapidly accelerated development of hardware and its widely hailed virtues opened broader, less sophisticated markets than existed during the formative years of commercial sales. Computer pitchmen reared in selling typewriters, calculators, television sets and electric razors, exerted substantial influence over this new breed of equally inexperienced, potential users. Subsequently, the myth of the assembler-compiler was effectively propagated as a substitute for adequate programmer training at the user level.

Earlier the user had accepted a major part of the software burden but the salesman had now convinced him this was both unnecessary and impractical. For the controller, confronted with costly new hardware and a gross lack of trained personnel, the closed shop represented a dangerously increasing responsibility for which he had little technical competence. Decentralization via open shops and ultra-sophisticated software offered an ego-saving blessing of no small proportion. He quickly concurred in dumping the entire problem of progamming in the manufacturer's lap.

Meanwhile, back at the corporate headquarters of the computer manufacturer, the sales pitch was either ignored as an interesting innovation or was so convincing that the manufacturer worshipped the words of his advertising copywriter and fully expected programs to be written with whimsical ease. There was no middle ground, and virtually no programming effort.

When faced with the reality of their commitments during the late '50s, some manufacturers had to "make do" with the quick conversion of a machine dependent language to a warmed-over version of a machine independent language. Others concentrating on "breakthrough" hardware and matching software soon discovered that not only was early software implementation difficult but if and when completed, programs would be incompatible with best-selling competitive equipment.

And since compatibility was thought a worthwhile direction, it was undertaken through the hefty persuasion of CODASYL via the COBOL effort. Subsequent publicity provided by a number of manufacturers convinced the user and the general public that complete compatibility was not only close but virtually upon us. By this late date however, the manufacturer knows better. The user does not!

While its history has been comparatively short, the problems of software indicate a many-faceted, enormously costly muddle. For example:

Commitments now have been reported for more than 100 different dialects of artificial languages which at present, conservative estimates

would require about 3,500 man years to complete. The number is growing rather than diminishing and the job is clearly impossible. Schedules for delivery of software are highly regarded by some users and flagrantly postponed by manufacturers. Programmer training is gradually increasing but at a pace hardly commensurate with the tripling projected for hardware installations by 1965.

Accompanying the economic pressures on manufacturers for operating, reliable, compatible software, a schizophrenia still exists in some segments of the industry. One major installation for example, persists in octal absolute coding despite the pleas of an embarrassed manufacturer.

The feverish publicity which manufacturers have garnered for themselves has in fact, served as implied commitments to at least partially fulfill their promises. If the present pattern is maintained it is not unlikely that penalties for non-delivery of software will become implicit in all hardware contracts and manufacturers will require similar financial retribution from non-delivering consultants and while punitive action will be rampant, the workload will continue to mount.

Of course, such an environment will sharpen an awareness of the problem, shorten tempers and stunt the general health of the industry so that a foam rubbered psychiatrist's couch may well be traded for a more restraining straight-jacket.

Implicit in any therapeutic suggestion is the cost of implementation and the difficulty in swallowing such a major investment which taken at face value, may not seem at all essential to the development and sale of hardware. It *is* essential however, and if this fact is not apparent, it will become so at a later date when the cost will be considerably higher.

At present, it has been publicly stated that for every 1,000 hours in the design, production and maintenance of hardware, about one hour is devoted to support the application. This imbalance is in fact, a ludicrous one and must be corrected.

To accomplish this, some manufacturers have initiated removal of software development from the sales and marketing departments and have provided the effort with the stature of a separate department.

However, dignity alone will not suffice. There must be adequate support provided in staffing the department not only with intelligent leadership but also with a sufficiently capable and complete staff to initiate in-house capability for major programming development, and to accomplish more than fragmentary efforts in programmer training, application studies and ultimately, r&d in software.

Encouragement should be provided for evaluating the actual costs to a user of for example, operating a compiler vs. an assembler in an open vs. closed shop, as well as to the manufacturer for the design and programming of multi-level packages. In this regard, there is an initial obstacle to be overcome: many users and manufacturers don't want to know their software costs. However, once this trauma is surmounted and an awareness of cost factors made known, there may develop some unique philosophies on increasing efficiency with far less fuss and furor.

To control the temper of software publicity, some initial evaluations should be made with various compilers such as determining precisely the time required to compile a single statement STOP. Evaluations should also be undertaken to rate compilers according to problem sets and the speed of compilation per machine, per set, per compiler.

With wider attention and a rationally organized effort both cooperatively and unilaterally, the testing of a claim will be more immediate and the potential of outlandish statements considerably inhibited.

However, despite all good intentions and a bountiful supply of dollars, the accelerated growth of the industry by its very nature will continue to present problems of immense proportion. If this fact is realized perhaps the fear of the problems will not be as great and facing them will be a considerably easier task. More than any other single, contributing factor, a proper mental attitude toward the necessity for software development is needed, and since psychiatry is almost as naive a science as software, perhaps one can in a limited sense, assist the other.

STANDARDIZATION IN EDP: "methodical"

ASA national conference reports on progress

Slow but methodical progress in data processing standardization was reported last month at the American Standards Association's 12th national conference in Houston, Texas.

A new character code to replace the 80 column card, current efforts in designating a type font for optical character recognition, problems in standardizing information retrieval and the formative work in standards for programming languages were reviewed by ASA committee members during a session sponsored by the Business Equipment Manufacturers' Association (BEMA).

In a status report on standards work of the X3 sectional committee of the ASA, Joseph W. Barker, acting director of the data processing group of BEMA concluded "we are attacking our problems logically. The proper determination of functional—or systems characteristics which will be in the best public interest and will not inhibit technological development, is a time-consuming one."

Urging deliberate progress in such work, he said, the computing industry should not rush into premature standardization that would result in "unacceptable low performance levels or else be disregarded by manufacturer and consumer alike. Our progress, to date, has been sound and we confidently anticipate meeting those target dates which we predicted sometime ago."

Application of any American standards that result from X3 sectional committee work will have a profound effect on the information processing industry, Barker reported. "In the final analysis, standards are proposed and adopted for the public," he said. "If the producers of equipment which relate to these standards are not in wholehearted agreement with them, they stand a smaller chance of universal and rapid adoption."

Standards for computers and information processing, currently being pursued by technical committee 97 of the International Organization for Standardization (ISO), will implement standardization of data processing equipment within the U.S., he commented. Having been assigned the secretariat of the committee, the U.S. was also assigned the chairmanship of three of the six working groups.

Discussing character codes and input and output media, I. C. Liggett, former director of systems standards for IBM,

R. E. Utman, manager of Univac systems standards, reports on progress in standardizing programming languages. Addresses were also given by (left to right, seated) B. W. Pollard, director of engineering for Burroughs; I. C. Liggett, management staff of Computer Usage; J. W. Barker, acting director of the data processing group, BEMA, and Mrs. Jessica Melton, Center for Documentation, Western Reserve.

emphasized that "a good standard character code is the key to this entire concept of increased communication." He said that a character code under development by the X3-2 subcommittee of the ASA will solve problems of cost relating to the interchange of information.

Object of study has been the 80-column card, Liggett said, which was originally adopted as a de facto standard to "facilitate an easy translation from card code to computer code." Ten years ago, he added, the 80-column card served the purpose, but "this type of computer code does not adequately meet the desired requirements for today and tomorrow's data processing and communication needs."

Liggett reported that the recommended standard is a single seven-bit dense binary code "representing the smallest set that can adequately meet our interchange requirements. We recommend subsets and a superset of the seven-bit code to meet the varied demands of data processing." He added, "these are four, six and eight-bit dense binary codes which are easily transferred into the seven-bit communication standard."

Application of the new code will not eliminate the use of the 80-column card, Liggett cautioned, since it will still be used in translation from card code to standard computer code, "although somewhat more difficult." It was his belief that assets to the data processing industry—likely reduction in manufacturing costs and increased communication possibilities—make the adoption of the new standard code economically feasible.

In a presentation on character recognition, B. W. Pollard, director of engineering for the Burroughs Corporation, said that a recommendation for an optical character recognition standard font may be submitted to the 18-member X3 sectional committee of the ASA next spring. He based his belief on the work presently accomplished by the three task groups functioning under the X3-1 subcommittee.

A resultant standard font will enable equipments and systems to interchange documents without major modifications or adjustments, he told the conference.

Seeking to arrive at one standard font size rather than two as had been recommended in task group discussions, Pollard said a likely compromise appears at hand on a standard font of 0.056 x 0.112. While task group 1, Printing, is concerned with this font size, task group 2 is progressing toward standard font shapes, he said, and has arrived at a decision that all character shapes should be based upon a 9 x 5 grid. Task group 3, meanwhile, is seeking to develop a set of format rules that will be suitable in all applications permitting documents to be intermixed with the minimum of adjustment to the equipment or systems.

The Burroughs executive noted that samples of print based on the recommended font are being scrutinized by task group 1 while signal-level characteristics (band of illumination, types of ink, colors of paper) are being studied by task group 2. With this increased activity Liggett hopes the subcommittee will tackle an alpha-numeric font in the not-too-distant future.

Problems likely to be encountered in the standardization of information retrieval were outlined in a paper jointly prepared by Allen Kent, associate director of the Center for Documentation and Communication Research at Western Reserve, and Jessica Melton, assistant director for technical operations at the Center.

Miss Melton predicted "as information retrieval systems emerge from the theoretical and experimental stages to the operational . . . standardization of those parts which can be standardized will be the natural consequence of common experience. . . ."

Parts of information retrieval, she said, consist of the following:

1. acquisition of documents ("technology is sufficiently developed to warrant serious consideration of criteria for standards of machine-readable source documents"); 2. analysis of source documents ("can be, and is profitably being investigated through the techniques of linguistics, logic, and mathematics"); 3. control of terminology ("modern data processing equipment also provides the possibility of standardization of this unit operation"); 4. recording of results ("it becomes possible to consider standardization of codes or notations, or both, and of hardware") 5. searching of the library file ("the use of computers for literature searching increases opportunities for standardization").

Miss Melton also noted that attempts are being made at standardization of the vocabulary of information retrieval since specialized jargon has conflicting connotations when used by proponents of various data processing systems. She emphasized that overall standards work involving retrieval should take into account that "certain operations and parts of operations are amenable to some degree of standardization."

(The substance of R. E. Utman's presentation on standards in programming languages is presented below and on the following pages.)

LANGUAGE STANDARDS... A STATUS REPORT

by R. E. UTMAN, RemRand Univac, Princeton, N.J. & N.Y.C. & Chairman Pro Tempore, ASA Subcommittee X3.4 (Languages)

From the lower machine-oriented level, languages have progressed upward from elemental actual machine code to regional and relative addressing schemes, modular languages requiring "assembly" process-

ors, assembler-compiler languages with processor that called upon stored libraries of subroutines during assembly, and compiler languages. The compiler languages have in turn grown from the artificial mnemonic and pseudo-term forms, to the almost natural languages of FORTRAN and ALGOL in the algebraic problem area, and COBOL in the English-language narratively stated class problems.

In spite of this improvement from elemental and synthetic mechanical languages to natural languages with automatic translation, the programming of problems has continued to be the most costly single element in the economics of electronic information processing. The necessity for heavy investments in programming, plus the fact that the "software" of a computer, is invariably unique to that machine and uncommunicable to or from any other, has been a severe limiting influence on the acceptance and growth of data processing. Small to medium businesses, which make-up the real volume market, find it difficult to afford the heavy initial costs of programming, procurement, *and* installation. Those that can and do, find the expense of maintaining their programming current with their dynamic business systems results in marginal economy. They contemplate going to higher speed computers as a solution to the problem, and find the reprogramming more complex and the costs even more prohibitive. Large companies and governments with multiple-source procurement policies are forced to buy from one computer manufacturer because it is impractical and costly to program their problems two or more times for different manufacturers' machines that have unique and incompatible programming languages.

Motivated by the discouraging economics of this dilemma, computer users have banded together in self-defense into the well-known "users groups," such as SHARE, GUIDE, USE, etc. . . . They have found the answer to these problems in one form or another of standardization. The community of users groups has recently organized to form a powerful and representative second-level association called JUG, an acronym for *J*oint *U*sers *G*roup, which now is beginning to speak authoritatively for the entire marketplace. . . .

. . . The development effort behind ALGOL and COBOL at the problem or natural language level have been attempts to achieve the simplicity, discipline and economy that standardization invariably produces. Such work has understandably suffered from insufficient authority, representation, and organization to enable acceptance as standards, and adequate maintenance. The groups responsible for ALGOL and COBOL have however, developed excellent and useful languages which have already realized impressive support as publication and programming languages. Most computer manufacturers, including those with proprietary languages, are acceding to popular demand and programming processors to translate these languages to their respective machines.

As must inevitably happen in such widespread implementation of new non-standard developments, the specifications have been found ambiguous or impractical of achievement. In this condition they permit such varied interpretations that some of the resultant processors can hardly qualify to carry the names ALGOL or COBOL. Yet they are being labelled and sold as such. There has been some success in improving the specifications, but the maintenance organizations have not had the time or resources to do this sufficiently. Language maintenance is a very demanding and expensive business.

This need in information processing was recognized in 1960 by ASA, and the responsibility for programming languages established within the scope of Sectional Committee X3 and its Subcommittee X3.4. Under the Chairmanship of Dr. J. Chuan Chu of Remington Rand Univac, a year of education and experience has since accrued and significant progress can be reported today.

The first thing the programming experts in X3.4 believe they have learned is that the problem of standardizing a language seems several orders of magnitude more complex than that of a unit of measure, a railroad gage, film size, etc. The various and familiar procedures have not seemed applicable to standardizing a mechanical language with its vocabulary and syntax, data description and transformation logic, environmental description requirements, etc.

In surveying the field of programming languages, for instance, to see if any widely accepted candidates already exist, it was immediately obvious that there are only a few languages of any universality. The two most prominent for consideration as potential standards—ALGOL and COBOL—have really not been used yet to any extent. Most translators for them are just now in initial stages of development, and it will be from two to three years before the worth of the languages is known, or an indication of their acceptability realized. *And in the explosive technology of the computer industry, it is not impossible that they may be obsoleted and inappropriate by that time.*

Two questions immediately come to mind at this point. First, why are there so few candidates when a survey of just the compiler languages reports more than 80 in use today in the United States alone? The answer is that almost all compiler languages are oriented to just one machine; and we are not prone to establishing national and international standards on one manufacturer's exclusive product unless the market is so dominated or demands such. All languages of lesser sophistication than compilers are usually even more one-machine oriented, and are not considered appropriate for initial consideration.

Second, if the question of acceptability of these languages will not be resolved for several years, why are we even considering standardization at this time? The answer has already been stated. . The varied and undisciplined interpretation of today's insufficient specifications will invariably lead to misrepresentations to the market place, unless some attempt at rigor and qualification as a standard is made.

Having established the justification and the need, X3.4 then considered the *how* of achieving a language standard. . .

In the year to date, X3.4 has primarily concerned itself with organization, staffing, education in standards procedure, the fundamentals of languages, and the survey of U. S. computer languages. Simultaneously with the survey, consideration has also been given to procedures for standardizing a language. . .

A third effort has also progressed in the basic problem of how to specify a language sufficiently, so that its processors can be readily implemented without ambiguity and misinterpretation. This is the really basic business of determining the common characteristics of languages, and even more fundamental language forms in which these characteristics can be rigorously described. Only in such elemental terms and specifications of language specifications will the rigorous analysis and comparative evaluation of competing languages be practicable. Dr. Saul Gorn, of X3.4 and the University of Pennsylvania, will soon publish the results of the work to date in "specification languages." In his paper he describes a "Baker's Dozen" of the existing languages used for this purpose. . .

Having selected ALGOL and COBOL as candidates, X3.4 is now involved in technical review of the present form of their specifications. The need is so urgent that the evaluation of their specifications and potentiality for standardization cannot wait for the orderly definition of

standard procedures and specification languages. In this case, it may be necessary to propose a specification that will represent the best that time permits. The opportunity to develop standardization methods and procedures on actual language examples however, will better assure the availability of the desired rigor by the next round of candidate considerations.

Next in importance to the consideration of ALGOL and COBOL is to assure the existance of complete and unambiguous specifications for them as soon as possible, and prior to the completion of their current widespread implementation, scheduled as early as mid-1962. This provides only a few months to achieve a considerable and pioneering standardization effort.

X3.4 has organized a working group for this purpose to be chaired by R. W. Bemer of IBM. He plans a schedule of work that will involve top people from computer manufacturers, special interest groups, and users, at least a working week per month until completion of this first ALGOL and COBOL objective.

As in every field of technology, a standard must be dynamic and maintained in order to be realistic, useful, and accepted. Along with the specification and proposal of standard languages, X3.4 will assume responsibility for assuring that organizations exist for their continuous review and maintenance. The experience with COBOL and ALGOL maintenance has been of mixed success to date, and as a result their acceptance somewhat hindered. The maintenance of an English-like language will be a considerable and costly undertaking. New methods, procedures and organization for the maintenance of standards may have to be explored and developed to support this vital function. Obviously, in every aspect of the standardization of languages we are involving very significant investments of our most important resources—i.e., the *time* of our most expert *people*—with associated costs in dollars. And such is the complexity and dynamic nature of languages and their maintenance problem, that these costs will go on and on. Suffice to say, the selection of a language as a standard will be an extremely far-reaching decision, very much in the tradition of all such standardization decisions.

Once a standard language is achieved, it will then be necessary to specify tests to be used in qualifying the variety of interpretations that will be labelled and sold in its name. There must be an organized discipline of some sort to enforce evaluations by these tests, and to administer a continuing program of certification.

Turning from the languages to their translators, it will also be necessary in the responsibility of establishing a language standard to develop standard criteria and tests to qualify such processors as may carry the name of the language. With so many different machines requiring unique and individual translation programs for the one standard language, we will have a situation analogous to English and its variety of national, regional, and local dialects. As it is difficult to control the growth and use of dialects, so it will be in maintaining a common identity amongst a family of mechanical translators. Yet one of the basic purposes in standardizing a language is to assure just this communicability amongst differing machines.

Finally, the procedure as now planned for language standardization recognizes the continuing necessity to search for simplicity in this fundamental aspect of communication. Rather than support the use and maintenance of two standard languages of differing application, for instance, it might seem reasonable to try to coalesce them into one. Combining English with an algebra, however, presents obvious problems, and much research and consideration must be given to any such attempts lest the objective is compromised in the result.

In summation of X3.4's national work to date, the organization and orientation humps have been crossed. The field of programming languages has been defined and the standardization objectives narrowed. Bounds have been described and goals set. Work toward them is underway. This seems a considerable achievement in itself for such a complex technology.

A survey has been completed of the compiler-type languages in use today in the United States. Analysis of this information yields at most a half-dozen languages of sufficiently broad utility to enable candidacy for consideration as standards. From this small group, two have been selected for immediate evaluation—ALGOL and COBOL—on the basis of predominant recognition and future potential acceptability as standards.

Simultaneously, X3.4 has begun research into the existence or development of basic languages for the rigorous and standard specification of programming languages, their comparative analysis, and evaluation. A glossary of programming language terminology is also being compiled as work progresses.

Recognizing the unique and unknown complexity of language standardization, X3.4 has also developed a preliminary procedure which will be applied to the consideration of ALGOL and COBOL.

Their review as potential standards has now begun, with the objective of recommendations to ASA some time in mid-1962. This should be in sufficient time to enable clarification of their status prior to widespread industry deadlines for processor completions.

If standardization of either or both of them is recommended, X3.4 will then propose the means for their maintenance, as well as develop test problems, criteria, and procedures for the qualification of the variety of languages and processors that will result from widespread implementation of the standards. X3.4 is also considering the problems associated with simplifying the standard language picture by such means as coalescing or combining languages.

Internationally, the U. S. has the secretariat or administrative responsibility, for ISO/TC 97 Working Group E on programming languages. X3.4 has been delegated to assume this secretariat, and has established a model organizational approach for its fulfillment. A special X3.4 Task Group has been working since June, 1961, under the chairmanship of Dr. Richard Clippinger of Minneapolis-Honeywell, to organize this international working group. It was actually under this egis that the valuable U. S. survey of compiler languages was initiated, since it will serve the purpose of providing other countries with a sample of the type of survey that has now been asked of them. In addition to compiling an international status report, X3.4 is similarly responsible for the preparation of a draft list of international projects in this field, with recommendations as to their priorities, scopes, and programs of work. All of this draft material must be compiled from the proposals of the nine participating countries and two international liaison organizations in TC 97 Working Group E, and circulated for their final review three months prior to the next plenary session of ISO/TC 97 scheduled for the spring of 1962. So far the work is proceding about 30 days behind schedule, which is considered a success in international standards activity.

In final summary, this is a very costly and demanding task that the ASA and computer manufacturers have initiated. Standardization of languages will fundamentally influence every aspect of the use of information processing equipment. The need for standards is so urgent that the industry recognizes it must invest now if it is to continue to grow. . . ■

MONSTER MARKETING

specifying, selling and supporting the giant computer

by Dr. H. R. J. GROSCH, Contributing Editor

A new generation of super-powerful information processing equipment is lumbering on stage, reminding this jaded spectator of nothing so much as a bunch of muscle-bound college football players dressed as chorus girls. Stage left, trying to pull their skirts down, two embarrassed line flankers: LARC I and II. Center right, arms interlocked and trying to get together in a simple tap routine, eight very heavy tackles and guards: the STRETCH boys. Far right, craning to get his seams straight, an oversized center: HARVEST. In the wings, practicing coy looks, the light backs: ATLAS. And still in the dressing room, hoping for someone to help with the zippers, a hot pass receiver: the CDC 6600. Oh, its going to be a show — if the whole cast doesn't fall apart in sheer embarrassment!

This is not the first time a really big jump in computer capability has occurred. Even if we restrict the list to cases where a decimal order of magnitude was gained in speed, storage capacity, or organizational flexibility, there are half a dozen prior examples. I've asked myself if we can learn from them, but I regret having to admit that our problems today are different. Most of the big jumps were early in the game: single adventures. The old Mark I towered over punched card equipment, ENIAC was a hundred times faster than relay machines, the Cambridge machine stored its programs, WWII pioneered two kinds of storage, marginal checking, and also set new speed records. In the first two cases, there was a faint supplier-customer flavor — in other words, a marketing problem: IBM built the Mark I for Harvard, and the Moore School built ENIAC for Aberdeen Proving Ground. But the prime idea was an engineering one: string together these new components, or these old components in this new way, and let's see how the resulting machine performs. Havens' NORC, and the old SSEC, which are marginal cases, were conceived and built *and judged* on that same basis.

One case where many machines were built and where marketing considerations were intrinsically and admittedly important was the IBM leap from CPC II to 701. I was on both sides of that one; the early UNIVAC I, which surely deserves listing if only because of the first use of tapes, is less clear. I don't remember that a customer pattern was much in evidence, except perhaps at Census.

And the IBM 701 story differs radically from the current situation in that there was a strong and sustained demand from two or three dozen square-hole addicts. So there goes our last chance for historical guidance!

Let's look at the special problems involved in marketing a super machine, in contrast with an 1107 or a 1401. Perhaps most important is the experience of the putative customers; such machines inevitably are bought or leased by outfits in the very forefront of the applications world. They are knowledgeable, they are demanding — in fact, they are difficult! A second factor weakens the manufacturer's resistance: he is perforce peddling a "paper" machine, far out, beyond his own guaranteed competence. Effective simulation on existing equipment is impossible,

so software development and customer time must await the prototype system. The builder's defenses are thus weaker than usual, against customers like NSA and Livermore who know well how to press the attack.

Third, and probably most obvious, the number of sales possibilities is lower, and the size of each sale much greater, than the usual large-machine case. In a typical situation, IBM might figure a large machine run of one hundred, leased at $75,000 a month each; for a giant machine ten times as capable, they would count on making perhaps ten, leased at $250,000. The former program is thus three times as important currentwise, but the latter is at least three times as important futurewise and prestigewise, Madison Avenue lingowise.

Bearing these special paremeters in mind, and getting a little positive and a rather larger amount of negative guidance from past experience, I would recommend this pattern:

1. A firm decision to enter the arena.
2. A commitment on production — ten or twelve machine systems at least.
3. Support for marketing at the same percentage level of total program cost as "standard" systems.
4. The various marketing components such as follow-on product planning, software, sales, and maintenance engineering funded and at work as soon as the hardware boys.
5. Early formation of regional teams, first to work at the development shop, then to represent their golem in a geographical area, and finally to work with a single customer.
6. Immediate and forthright announcement.
7. Pricing early, subject to frequent and frank revision, and aimed at a standard profit level.
8. Frequent, honest progress reports to the technical press and to prospective customers; no advertising or public relations effort.
9. Customer suggestions fed into follow-on planning, consolidated there with internal requirements, and used. Try to work with individuals and avoid a SHARE gang-up.
10. Within reason, let 'em visit — it's the most powerful sales tool in the world!

I'd like to annotate and justify some of the above in more detail, without belaboring the matter too much. Take Item 1, for instance: top managements in Univac and in IBM were reluctant to admit their giant machines to a place in the product line until long after they were deeply and irretrievably committed in money and reputation. Remember my opening simile? Nothing repels a sophisticated customer more than a billion-dollar corporation trying to act coy!

If a giant is worth the trouble, he should have brothers. The crib, the bathinette, the baby clothes all cost too much for one Pantagruel. The day of the one-off machine, except as a component or logical design test bed, is long past. The internal IBM plan in late 1958 was "six to twenty" STRETCH systems, but this never counted with Galactic Headquarters until the reluctant 1960 announcement. ATLAS, on the other hand, was planned as a line system from the beginning, and for quantity production.

HARVEST, alias 7950, looks like a special problem. But is it? Certainly the system forte is non-computational. So are the tasks of the censuses and of business data handling. I believe IBM could have sold six or eight in this country alone, if they had set out to do so in 1957. Top management in the computer racket resembles piloting the new jet aircraft: low and slow ain't the way to go!

Now, about money: in my view, the marketing cost has been and should remain a constant fraction of a machine program. In a 160 or a 1401 deal, most of the money goes for sales and advertising, just as it did in the punched card days. With the intermediate machines, customer education and support, and maintenance arrangements, take over. Finally, at the large machine end of the spectrum, the expenses of programming techniques become — or are becoming — dominant. Univac and IBM both tried to skimp on marketing support. The idea was to keep total costs down; mass production was ruled out by timidity, so component and assembly costs were essentially irreducible; research expense and corporate overhead were fixed items. So what was left out? Fancy diagnostics, storage allocation, an elaborate executive routing, customer application studies, and even — wonder of wonders — a genuine sales effort!

It is hard to put a single level of support on paper for outfits as diverse as IBM, Ferranti, and CDC. Let me weasel a bit, and say that for a typical well-managed major computer manufacturer, about 30 per cent of the total program cost ought to go into product planning, sales and sales aids, maintenance techniques, customer training and support, and software. And I exclude from that rather high figure such hardware items as spare parts and such corporate or multi-program costs as research and development. If LARC or STRETCH had been so supported, as part of a total ten-year program of perhaps $100 million, at least five times the marketing support actually given would have been available. And STRETCH, for one, would have come much closer to its scheduled delivery.

To sell a single system worth over $10 million requires new tactics as well as a sensible strategy. My idea of the marketing team envisages a customer engineer type, a systems programmer or two, a product planner/logical designer to absorb feedback, and a team manager with heavy operations experience. A real sales type — a closer, a foot-to-fire holder — is not needed in most cases; the regional sales manager can drop in at likely moments, and pick up a few entertainment tabs. If there is to be a commission or a bonus, it should be divided between the team members; the sales manager can have the quota points!

The time will come, I'm sure, when sales pressures will mount again, even for avant-garde computer systems. But this will happen only when top user executives are as familiar with giant computers as top utility executives are with steam turbines and electrical generators. That's more than a decade away in banking and insurance, let alone general manufacturing. Until then, the hot-rock political salesman should hibernate.

Remember, in specifying and in selling a STRETCH or an ATLAS, the customer is strong. A good marketing strategy will use that strength, not struggle against it. Let the customer share the burden of product planning, of design changes, of systems support. Before he knows it, he's intellectually committed — the most effective salesman in the world, and the cheapest. Who sold all those big IBM machines in Los Angeles, for gosh sakes? The customers sold 'em to each other! On the other hand, customers can be *too* strong. . . . and out pops a 709. The way to avoid extremes — no seduction, no rape — is to open the information channels, right up to the limits imposed by patent requirements. Coordinate the dope, centralize its issuance, register the feedback: unrationalized, the wish-wash of words can do more harm than good. But handled sensibly as well as liberally, customer information flows are invaluable.

I'd rather market an ATLAS than an SS90 any day; it's cleaner work, the pay is better, you meet nice people. But new techniques *are* needed. And top management courage. Hardware, believe me, is the easiest part! ■

TRW: A POSTURE AND POTENTIAL

based on an interview with Dr. SIMON RAMO
by HAROLD BERGSTEIN, Editor

The present posture and potential of Thompson Ramo Wooldridge in the field of automatic information processing has recently been viewed by a wide spectrum of industry opinion with more than a modicum of conjecture and speculative guesstimating.

Although progress on some aspects of contractual work for the government has been reported (including the development of the polymorphic and stored logic concepts), official pronouncements of new hardware from TRW for general purpose applications have been comparatively sparse in number and seemingly noncommittal in nature.

On the other hand, verbal reflections on the computing industry by TRW's management have been widely disseminated and imply a firm intention to exercise both intellectual and technological leadership in the future of the industry.

To lend definition to this somewhat grey, as yet seemingly paradoxical posture of TRW in edp, DATAMATION recently conducted a taped interview with DR. SIMON RAMO, executive vice president and member of the board of directors of TRW. While the following article should not be treasured as a comprehensive, all-seeing guide to the corporation's innards, it should provide the reader with some insight into a segment of the company's executive thinking as well as a highly palatable view of the industry's potential in light of present-day problems and accomplishments.

Q: Dr. Ramo, our first question is double-barrelled. Could you explain some of the background factors responsible for development of the polymorphic concept and at present, how serious is TRW in marketing this concept and its associated hardware commercially?

A: Thompson Ramo Wooldridge has been engaged for the government for some years in developing large-scale computing systems which are polymorphic. This came about because the particular projects involved required multiple use of a computer with a very broad spectrum of individual problems that had to be handled simultaneously.

To obtain reliability, to get a minimum cost for the installation, and one that would be capable of growth without a major change in the whole setup, as well as to make

possible a parallel-use operation, we were led to the concept of the modular computing system in which there could be a multiplicity of computing elements tied to the users through a central automatic switching system. Naturally we have contemplated from the beginning that those general principles should be useful in commercial applications; we still think this is the case.

Q. What specifically is being done to implement your plans for commercial availability of this system?

A: We think that most commercial applications that would allow the user to exploit the advantages of the polymorphic idea involve big installations. As yet, we have not completed our own engineering and market studies of what we should do commercially in this field although we are active in it; as of today we do not offer on the market, and we have not sold commercially, such a major installation. We think that it is important for us to make known to people who might require such an installation, that we stand ready to consider it with them, and as a matter of fact, we can take the hardware that we have designed and make necessary new designs based on the general principles. We're engaged in doing some of these explorations although it will take us some time before this work is completed. There are already too many large computing systems on the market. We shall not come out with still another until and unless we are certain that our design by-passes the present generation.

Q: We understand that you are presently employing a CDC 1604 and 160A. How is this effort related to the polymorphic concept?

A: One of the tasks that we are carrying out under contract involves multiple interconnections of computers through polymorphic central switching, and it is in that connection that we are tying into various existing commercial computers. It is not merely a question of demonstrating that it is feasible to do this, because to a considerable extent one can accept that as a fact from a paper study of the basic details of making these interconnections; it is rather that there are a number of other important aspects of multiple computer operations where there are alternate approaches to the problem and where there's some inventing yet to be done to find out how to exploit the polymorphic principle to the greatest advantage. We're doing that kind of investigation.

Q: Likely, in or for the military market?

A: Yes, although there is nothing so unique about the military market that it can't be transferable. For example, take management control systems and information retrieval, both of which have been talked about a great deal. Suppose a really large step is ready to be taken by a large industrial enterprise in which let's say there are a substantial number of key executives who have need for not only being informed as to what is happening, but being brought into the act at the right time to influence the execution of plans and the modification of plans in order to meet their optimum goals. This requires going much further in automating information flow than is true of the average business. At present, we're studying this with a view towards potential commercial marketing of equipment implementing these ideas. Meanwhile, we expect to go on successfully performing such work for the government.

Q: How successful has the AN/UYK-1 been in your sales to the military market?

A: It would appear that what we've done there has been very successful both from the engineering and applications standpoint. The computer is doing very solidly what it was intended to do.

Q: Are there commercial applications for the stored logic concept?

A: Yes, and we are basing our new commercial product plans in part on that. Actually, AN/UYK-1 is built to military specifications; in some ways it is over-designed for non-military uses. On the other hand, the extent of penalty you pay for this over-design is in some cases pretty trivial because the computer may be only a small part of the total system, and the ruggedness and reliability may interest some customers. Some design principles and concepts of application that make the AN/UYK-1 useful for the military, makes those same basic design ideas also useful for the commercial market.

Q: If a non-government customer came to you today and said, "I've read a good deal about the AN/UYK-1 and it looks as if it might be useful to our organization. Would you sell us one?"

A: Yes, I see no reason why we would be precluded from making such a sale. Certain aspects of the AN/UYK-1 are classified, of course, but they really have more to do with the way it ties into a classified system. The main frame is not classified. For general applications you need the proper input and output devices (which as a matter of fact we are engaged now in bringing through prototype stage). We are developing truly commercial computers using the stored logic concept, and the necessary ancillary equipment, but I would not want these remarks to constitute a premature announcement.

Q: Will future announcements include the CM 403 which has been described as a very large scale successor to the 400?

A: Announcements in the immediate future will apply only to medium sized computers.

Q: Can any of the virtues of the stored logic and polymorphic concept be combined into a machine for marketing by TRW?

A: Clearly there is no inconsistency between the two concepts. For example, suppose you have justification for a central "switch" so that you can automatically create large or small computers depending on the problem requirements of the multiple subscribers. This still leaves open many aspects of detailed design of the internal elements, and you can obviously design a computer with emphasis on internal wired programming, storing what might otherwise be put into the external programming. How you do this, optimally, would appear to depend a

great deal on the applications.

Q: Concerning the MIPE (Modular Information Processing Equipment) program, in a recent (August 4th) issue of the TRW Review a statement was published that "MIPE was nearly pronounced dead last year." Would you care to comment on this?

A: There is some confusion here, between MIPE in general, i.e., the modular information processing equipment, a polymorphic installation, and the several specific military programs for which it is considered applicable. One military program which was a major source of sponsorship for our polymorphic work was cut back last August, though not stopped. We were ahead of the rest of the program. We were on schedule while much of the rest of the program was not, and this caused a sudden curtailment that was quite dislocating, as such curtailments are. I think it was the first major curtailment of a program in the whole intellectronics field since Thompson Ramo Wooldridge has been in this business, but the program is continuing and the hardware items are going along on schedule. There have been numerous successful demonstrations of working hardware and there would be a number of major applications now being formulated and funded. We expect MIPE, in other words, to see considerable use by the government in a number of applications.

Q: The introduction and marketing of the 300 and 330 systems have certainly been accomplished in an unobtrusive fashion and as compared to some lines of competitive equipment, has been almost unnoticed. What is TRW's position in regard to the process control field?

A: It is our feeling that there has been and continues to be too much high pressure selling and "shouting of wares" in the computer field – evidence of too many companies in it, oversold on its immediate prospects. In process control, at any rate, as compared with the overall field of computers, a quiet marketing operation appears to us as adequate and perhaps most desirable. The country now seems to be full of companies engaged in large campaigns to make known their position in the computer field. On process control, we were first with a specific design, first to "close the loop" to completely automate a process, we have the largest number of installations, we

certainly have clocked the largest number of hours of operation, and we are known to all the key customers. There are not a large number of these, perhaps hundreds only, not thousands of concerns who in the next year should interest themselves in the installation of a major process control system of a specialized kind. By a specialized kind, I mean a system in which process control precisely is what you're after. Now, when you buy a general purpose computer and occasionally use it to aid in some aspects of process control, this is another subject. The TRW 330 is a new, specialized, process control computer which is capable of flexible operations for many applications of process control.

At present, we think that we can make all of the effective customer contacts we need on pretty much a personal basis by our specialists in the field. Typically, in the kinds of applications we're looking for, you start out with a very close relationship with a customer and with his engineers who understand the process.

We went into the process control computer business because we felt that as compared with most conceivable competitors we were strong in systems engineering as well as in electronic computer designs. And you certainly need to have good systems engineering in order to see how the whole process control system should be altered to make best use of electronics. But you need to do this in close company with the customer. You don't go out with a big sales campaign alone, and say "Look, we've got computers to sell for a certain price; this will revolutionize your business." That is baloney to sophisticated customers. Instead you sit down and say, "Let us see together how electronic computing techniques with appropriate auxiliaries can improve your operation by either showing a better return on investment, or getting a better product out, or setting the basis for expansion plans for the future, or giving greater stability and assurance of success, or of adherence to schedule." We provide studies toward these ends that are quantitative and not typically of the sales type. Most of the time these studies have shown that there is an important advantage in process control. At that time we become suppliers of apparatus in a competitive situation and often, but not always, we win the award. The large public relations effort to cause the customer to feel that he's dealing with the best outfit, that it has something specially unique, is less important than these more difficult, time consuming steps. However, we will be doing more advertising of the new TRW-330 as time goes on.

Q: What has your general sales picture been during the past year?

A: If we take all of our sales (in medium size computers—not counting the large polymorphic systems) and we take domestic and foreign, commercial and military sales, then in 1961 so far, we have sold over three times as many of these systems as in all of 1960. They run around a quarter of a million an installation. This is a very fine increase in our medium size computer business. We particularly intend to bring out more products in the medium-size area.

Q: TRW's introduction and propagation of the word "intellectronics" to describe a large segment of your activity has drawn some controversial commentary from the industry. What are your present feelings about the use of "intellectronics?"

A: We have made no effort, and intend to make no effort to make "intellectronics" a Thompson Ramo Wooldridge word, one that we can alone use or copyright as a trade word. We have no interest in any special word to help sell products. The reason for our use of the word is because we need a word – we all need a word. I would like to know what single, convenient word one can use to say "the extension of the intellect by electronics." Now

if you use "computer" for everything – well obviously, in an important sense, that is narrow, the computer is one element only – one of a group of electronic devices. What do you call what you do in extending the intellect when teaching with an electronic teaching machine – neither "computer" nor "data processing" well describes the technology?

Now I personally share with many people a bias against trick words, synthesized words. From that standpoint I don't like the word "intellectronics;" but I have come to accept various synthesized new words; we have them in the vocabulary all the time. When you have a need, you must attempt to fill it.

Q: There have been numerous projections as to the growth of this industry of which intellectronics or man-machine communications is certainly an impressive part. What is your projection for the economic growth of computing?

A: I feel intuitively that intellectronics – you see your use of the word "computing" in your question is inadequate – simply has to become our largest industry. This is because if one looks at everything that man does with his brains in any field or profession: government, military, business, transportation, one generally can convince himself that there is a part of it that could be done better if it were done by a man-machine partnership instead of by man alone. And you see at present, machines and many of the concepts don't exist to make this economically possible. But it would appear that science moving along, will make possible the existence of satisfactory economic solutions. You also observe that the needs are great, that everywhere the quantities and rates, size, interactions on all of these intellectual pursuits involve a tremendous amount of low-level information handling, processing, categorizing, displaying, retrieval, lower level intellectual tasks better done by machine, but always with a great deal of interaction at a higher level than man appears to be very competent to handle.

Now, if there is the need, and there is a technical solution for filling it economically then you'd expect the industry growth to follow. Thus, I fully expect the extending of intellect by electronics to be our greatest industry.

Another aspect of this is whether or not the industry will develop at such a rate as to make possible a properous, orderly increase in volume to accommodate all of the organizations now in the business. I think we must expect continued instability and false starts here. There are too many entries for the limited market of the next several years. I think it's necessary for us to combine imagination, seeing well out into the future, with practical solutions to the base problems. There will be a tendency for industry in part to overshoot, and without adequate preparation in terms of understanding of market and the application to design equipment that won't quite do it, even though there will be conservatism in some quarters that will preclude doing what technology makes possible to meet a problem. I think the government is a tremendous factor because the government is forced, largely through military operations and as a matter of urgency, to push for answers to problems, where in a commercial business it is possible to wait a little longer. I think we will see many companies with losses or poor earnings, having in effect to spend a great deal of money in order to buy their way in. The stable period ahead, is quite a number of years away. Then there will be large companies and medium size ones and small ones.

Q: Approximately as many companies as we have today?

A: Probably more than we have today. Every day others are coming into the business, many still with the mistaken impression that because the field is going to be tremendous, and because it is new and offers opportunities, that there is a high probability of success in a short time. There is *not* a high probability of long term success in a short time. There is, I would say, a high probability of success for a small fraction of those who apparently want to get into it,

Q: In dollar volume what do you project for TRW in the future?

A: We see ourselves in the hundreds of millions of dollars in intellectronics in the future. We don't have to be in the billions to be stable, but no company can be in the tens of millions in intellectronics unless it is a supplier of specialized parts.

Q: Suppose the cold war no longer becomes as cold as it presently is or as hot as some persons have anticipated, and the government decides to reduce its expenditures for the military and cancels many of its very heavy commitments for man-machine communication systems. How does the basic r&d effort in the computing field continue at its present pace and more specifically, what effect would this have on TRW?

A: The very things that make the cold war, or a hot shooting war, a permanent situation means that some other things are true. If we assume that somehow, our huge military budget disappears, we still have to assume a technological race with the rest of the world. In military pursuits in this technological age, aiding the human intellect by more machinery, predominantly, of course, by electronic devices, is the answer to many problems that we face. Sudden peace, though unlikely, would greatly dislocate the industry. But the military is not the only user of future intellectronics. For example, huge government expenditures for education would create a complete counterpart of the defense department. Large technological projects producing radical changes in the nature of educational operations in the country would sponsor r&d, so also would improved international communications, navigation (air and sea), weather control, and space research.

Q: Assuming there are no dramatic changes in the economic condition of the country, or that there is continued growth, how far are we from actual accomplishment

of, for example, an information retrieval system of some practical value? There has been a lot of general talk up to now, and much of it necessary talk; but how far are we from actually accomplishing even the first major step in this direction?

A: To get very huge systems that will contain a tremendous amount of information and make possible its convenient access, to have the store of information and the means for keeping it up to date, putting new information in, with means for practical utilization – so it really affects a professional operation, a government operation, a major business operation, is in my opinion from five to ten years away; and it will get there by a series of steps, probably some false starts. I look for the government to be the major or at least, the first sponsor.

There is a large amount of theoretical work going on (and by theory I do not mean speculative, imaginative talk about possibilities which exist; I'm talking about basic, difficult, conceptual theories) in an attempt to understand what we really are talking about. Here and there, gadgets are being developed. These are embryo devices and they have a role but the problem is really in taking a large corporation, a government organization, or a military command, and asking what do they really need in the way of information, and how can we make a very substantial difference in the way the information is stored and retrieved, so as to completely change the operation. So far as I know this is going on today only in connection with military projects on a highly classified basis, and with only the surface being scratched so far. Of course, this whole field of intellectronics has had a way of moving rapidly and it will certainly continue to do so in business management as well–a lot can happen in 5 or 10 years.

Q: How do you feel we compare with the Russians in the field of intellectronics?

A: Well, first let me say that I lack confidence in the information available in this country as to what the Russians are doing. I have talked with people who have done some studying in this area, and I think we could be misinformed and wrong in our judgment. But from what comes to my attention I would guess that we are probably on the average, a little ahead at the present. Undoubtedly they are ahead in certain areas. A typical reason, and not the only one for my saying this, has to do with a typical comment from people who have visited the USSR. They have been shown developments which were rather old by comparison to work currently in progress in this country, while despite this fact, the Russian director of the group points to this work with an extreme of pride.

However, I also have an impression that the rate of buildup in the Soviet Union in this area is perhaps greater than ours.

I think we are plagued today in the intellectronics field, with just the chicken-and-egg problem that you touched on in the way you stated an earlier question describing the possible application of our polymorphic system to commercial applications. We know that we can't revolutionize all intellectual pursuits all at once. We must find ways to introduce small steps rapidly. In a business we need to install management control systems for master scheduling, monitored operations, in which comparisons against a plan are made with man-machine relationships, on a partial, gradual basis. Yet it appears that it's very difficult to justify an installation unless you're going to go to a large scale. A large scale is economical and justifiable on paper. On a small scale it's nip and tuck or unjustifiable too often. We can't take a chance on the big step and the little step doesn't pay off. So this means that we depend a great deal on government and military sponsorship to take the really big step.

In the Soviet Union, I think they're probably a little bit behind in the breadth of instrumentation which we have in this country; in the number of suppliers of all kinds of the little specialty techniques needed to put over large man-machine communication systems. When they have passed that stage (perhaps it's only a few years away), then their good theoretical work, merged with this new availability of specialty techniques, will perhaps cause them to create system prototypes rapidly and ultimately, huge automated factories. They'll certainly move on man-machine partnership which is still rather embryo in this country, even in a theoretical sense. Thus, even if we are generally ahead of the U.S.S.R. today, there's a great danger that this may not be the situation a few years from now.

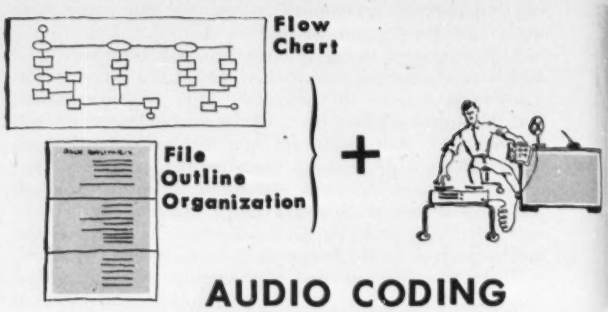
We have a few brilliant theorists engaged in studying artificial intelligence, learning machines. They would like to understand how far you can go or what directions are the best ones to take to design ever smarter electronic devices and systems to move to the higher levels of intellectual tasks. And there is interest in how the brain works, in using the brain, perhaps, as a model; there is growing up now improved, very fine, communication between the biological experts and electronics experts. Every year as you look at the results of symposia, there appears to be greater and greater understanding. But there's one thing that seems to dominate; it is always the unaided machine alone as a brain, the electronic device or system to do the task, to organize itself; theories on how the human brain learns, and self-organizes, and adapts, and how one would program or design a machine internally so it's capable of doing the same. I have a feeling that the greatest advances will come out of man-machine partnerships. I think we need a larger fraction of our inventors and our brilliant theorists on these partnership conceptions. Actually what we have been doing at TRW is concentrating a little more on this man-machine partnership in intellectual pursuits.

Q: To conclude Dr. Ramo, there has been considerable debate over the future of large vs. small computers. Which side of the argument if any, do you favor?

A: If I were to venture a guess, it would be that there is a permanent need for the whole spectrum. It would be nice to be able to get a beautiful simplification, but I think that there is need for large machines and small machines to be connected together, and small machines that operate individually (and again, you see, you've used the too-narrow word "computer.") I think that there is going to be a recognized need for many devices. Some will do nothing more than store information or collect it. Some will specialize in delivering data by one means or another to a central repository. This central repository of memory may not dominate, or shall we say monopolize all the memory of the system since memory may best be distributed. In our government, or school or factory, or airline you may find memory all over the place. Ability to sort, categorize, inform, display, call attention to, to view with alarm, or accept docilely and put out quiet deliberations on a casual basis–devices with these functions will be contained in cells distributed geographically, even nationally or throughout a building. The overall system is some sort of an electronic information processing system, although it doesn't just process the information but it's engaged in presenting it as well, and you will see human beings and machines working together. For all of this there is a tremendous market; but to get from here to there requires doing smaller jobs gradually, inventing the devices and techniques, building big and little computers. Somehow we must solve the chicken and egg problem and gradually evolve in this direction. ■

AUDIO

In the next few years we will see some interesting experiments in Direct Audio input to computers. Currently the RAND Corporation and MIT CompLab are exploring the man-machine interface. IBM's San Jose Labs are developing equipment to combine some of the steps shown at the right. Below is the report of a similar experiment which you may try in your own installation. The work was performed under contract to the Electronic Data Processing Division of Minneapolis-Honeywell, Wellesley, Massachusetts by Robert L. Patrick of Northridge, California.



AUDIO CODING

NAME OF EXPERIMENT: Dictated FACT

NAME OF EXPERIMENTER: R. L. PATRICK DATE: 30 April 1961

OBJECT OF EXPERIMENT: To determine the feasibility of using audio means to communicate program instructions to a general purpose digital computer.

SUMMARY AND CONCLUSIONS: The table below indicates that a properly qualified individual, supported by the latest equipment, can achieve an appreciable decrease in coding time through the use of an audio to digital translator. To achieve this improvement in output, it was necessary to flow chart the entire job, to organize the files in detail, and to keypunch the file organization cards before the narrative statements were attempted.

	TIME TO STATE AND CHECK SOURCE CARDS	NUMBER OF SOURCE STATEMENTS	TIME PER 100 SOURCE STATEMENTS
DECK G (Manually Coded Thruout)	8.05 hrs	161	5.0 hrs
DECK J (Narrative Portion Dictated)	2.50 hrs	200	1.25 hrs

PROCEDURE:

1. Obtain from customer complete problem statement giving all inputs, outputs, formats of reports, and intermediate processing.
2. Devise a process chart for the entire application. Show all manual, semi-automatic, and computer processing steps.
3. Flow chart the computer processing in detail.
4. Review the process chart and the flow chart with the customer.
5. Organize the files. Describe in detail and name each field.
6. Prepare the narrative statements which will cause the computer to perform the processing.
7. Combine the narrative statements, file organizations, and supplement with control cards.
8. Submit for first compile.
9. Prepare first problem in test series.
10. Correct errors noted by compiler.
11. Start checkout phase.

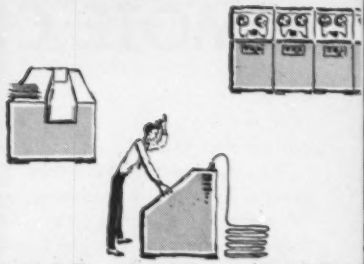
DISCUSSION: The above eleven steps were performed for several procedures during the course of this experiment. Decks G and J contain approximately the same number of narrative statements. Their flow charts are of like complexity. The names of the fields in both procedures are similar. The statistics from these two decks are given above.

Program Deck G was prepared using manual techniques throughout. At Step 6, the only materials used were 80 column source statement sheets and a pencil. In writing the manual statements, it was found that fatigue rapidly set in. Long field names

IO TECHNIQUE CUTS CODING TIM

AUDIO TO WRITTEN

KEYPUNCH



READ AND COMPII

give excellent readability but require many accurate pencil strokes. Abbreviations help at a cost in readability. It was found that the coder was output limited. It was impossible to speed up his output rate and still retain legibility for subsequent key-punching operations. His mind was found to wander and subsequently throughput decreased due to coding errors.

On Program Deck J. the experiment approximated a digital computer with direct audio input. Before this was tried, an office dictating machine was obtained and a secretary was instructed in its use. The girl obtained was one already familiar with "computerese." Specific instructions for typing Dictated FACT were published.

The completely organized files and flow charts were placed side by side on the work table. The office machine was set up and the dictating started. It was necessary to dictate commas, periods, and name separating hyphens in order that the final copy was in the required format. In addition, paragraph names and paragraph indentations had to be called out. Whenever any paragraph was named, the paragraph name assigned was entered above the appropriate block on the flow chart. Whenever any forward references were required, that paragraph was named and that name placed on the flow chart, too. A paragraph naming technique was devised which was pseudo-symbolic and allowed paragraphs to be named without ambiguity.

As the dictation progressed, it was found that this was a challenging task for a qualified programmer. It led to a higher level of concentration, less errors per page, and more throughput in a day. The above statistics indicate that a significant decrease in coding time was obtained.

The dictation was transcribed onto typewritten sheets. These sheets were edited for coding errors before the final transcription. Better than 80% of the lines of rough dictation were 100% accurate and did not need retyping prior to keypunching; 20% of the lines contained one or more errors. Only 5% of the errors were typographical; 95% were in the dictated prose. Of this 95%, some consisted of incorrect names which would have resulted in "undefined names" had they not been caught prior to compiling.

A significant portion of the errors were of a circuitous type. These errors consisted of statements which were proper. Their verbs were verbs out of the compiler's lexicon, were properly used, and the sentences were structurally sound. The field names used were legitimate and would have caused processing to take place. Unfortunately the processing called out did not match that specified by the flow chart. In short, these statements would have slipped through anything but the most sophisticated of inanimate automatic input editors. Due to the line-to-line-overflow problem, it was necessary to redictate some paragraphs in order to correct these insidious errors.

This experiment shows that the coder of a narrative language who can dictate accurately can accomplish more checked source statements than can a person armed only with pencil and paper. It appears that a proficient keypuncher should be able to keypunch directly from the recording. A listing of these cards would serve as a rough draft copy, and corrections could be made directly on this listing. Furthermore, this work indicates that the construction of an automatic editor for audio input will require an extended development period. This period should probably parallel the development of direct audio input equipment for computers. ■

ECONOMICS OF REMOTE COMPUTING

the RAND symposium part 3

"On reading the transcript several times, I am of the opinion that to publish it would be rather fruitless."

This pointed counsel which DATAMATION has flagrantly disregarded emanated recently from one of the 19 participants in this year's RAND Symposium. As a proper setting for this third and concluding segment, the reasoning for this evaluation is offered with tongue tucked tightly between two well-ground molars:

"On almost every substantive issue, we hemmed and hawed, and did random walks through, around and over the point, but very seldom did we lay out the issues, and come to any conclusions, let alone arrive at a consensus or a basis for such conclusions.

"On more opinionated subjects, we aired our contradictory opinions, and behaved as a group of philosophers at a convention.

"The one positive point that I could make in favor of publishing would be that it shows just how far information processing is from being a science, and its present near relationship to the occult."

For its fourth successive year, the RAND Symposium was held one day prior to the opening of the Western Joint Computer Conference (May 8th). Chairman of the session was Robert L. Patrick, a RAND Consultant. Other participants included: Robert Bemer, IBM; Herbert Bright, now with Philco and formerly with OEMI; W. Barkley Fritz, Westinghouse; W. M. Carlson, DuPont; J. P. Eckert, RemRand; Douglas Englebart, Stanford Research Institute; Bernard Galler, Univ. of Michigan; Maury Halstead, Naval Electronics Lab; Santo Lanzarotta, IBM; D. D. McCracken, Consultant; Norman Sanders, Boeing; Dura Sweeney, IBM; Herbert M. Teager, M.I.T., and Frank Wagner, North American. Representatives from RAND included: Paul Armer, Patrick, Fred Gruenberger, Keith Uncapher, and Richard Van Horn.

PATRICK: The topic now open for discussion is whether remote computing is economically feasible. Pres, would you like to say something about the Remington-Rand 490 real-time with gadgets strung on to infinity? Your outfit is getting into this sort of thing in a big way, aren't you?

ECKERT: It depends very heavily on the telephone company and the economics of communication. It seems that today certain classes of information can be transmitted at rates which are an order of magnitude cheaper than they were just a few years ago. At that time I was convinced that this idea was not economically feasible, but there has been this profound change in the rates and I think it should be re-evaluated .

CARLSON: Isn't this the real problem? Everyone says that we have to evaluate this situation but we can't do that until we have some real numbers to deal with. Does anyone here have any real numbers?

ECKERT: There's quite a lot that can be done just within a city when you consider that an ordinary line rents for couple of dollars per mile per month. Now a keypunch represents somewhere around 30 or 40 dollars per month rental and in a keypunch the keyboard represents about 1/6 of the cost of the machine, the balance being in the card-handling equipment and the punch dies. Therefore, keyboards scattered around the city, connected by telephone lines to a central location, through a simple transistor gadget, might be as cheap or cheaper than the present keypunch set-up.

WAGNER: I think this topic is not only not defined, but darned near undefinable. For example, remote computing is obviously economically feasible when we're controlling a missile with a computer on the ground. I don't think you can talk about the subject in generalities; you have to be specific. For example, I can talk about it in the framework of my own particular computing problems at North American Aviation. It is a serious problem for us. As most of you know, we have three fairly large computing centers. One is in Downey with the 7090, (shortly to have another one), the Los Angeles center has two 7090's, one 709 and three 705's, and the installation in the valley has a 7090 and a 709. It's fairly obvious that the question has come up as to whether or not all this machinery is not uneconomical, since it seems to be generally acknowledged that the larger the computer you get, within limits, the lower the cost per unit of calculation. One is tempted to ask, "Wouldn't we be better off economically in having one very large inexpensive computer doing all of this work?" As you can well imagine, we look at this question pretty hard. The conclusion we have come to so far is that it certainly doesn't look fundamentally feasible. Until it proves fundamentally feasible, we won't even begin to worry about whether it's *economically* feasible.

Now why do I say that it's not fundamentally feasible at the present time? (And incidentally, by that I mean within the next three years.) First of all there is the obvious problem of disaster insurance, and by that I don't mean disasters like hydrogen bombs, but the type when the machine goes down for four days. This sort of thing happens to us every so often, not *too* often but not so infrequently as to be negligible. We feel that it's necessary to spend the fantastic amount we are now spending for our computers, and that is the reason for them – that we think they are necessary. And you can't argue with that reason. Therefore, we find it completely impractical to be without computing for a few days. We would not want to afford to be without a running computer, not even once in five years. So if the concept of remote computing involves a single computer, right away we've eliminated that.

So how about remote computing with several computers? Well, our experience to date with transmission facilities (admittedly prototype facilities) has indicated that those parts of the system too are not very reliable. Always when we could best use the excess capacity at Rocketdyne, we can't get the system to work. It always seems that we can get it to work an hour or two from now, but not right at this instant. I realize that we tend to remember the bad times and forget the good, but nevertheless, it happens often enough so that we can't rely completely on the transmission system unless we duplex it.

That brings us to another factor involved in operating a remote installation and that is the human factor. When we're talking about sending work to a remote installation,

we can't avoid, with the way we presently operate, having some human get his paws on it. Under these conditions it's awfully hard to satisfy the customer. When we send a job, by all known rules of logic, it should be back in eight hours, but since someone has his hands on it at the other end it doesn't come back for 16 hours. During the second eight hours in which the sender is trying to find out why his work hasn't come back, he has to get in his car and go over to the remote installation where he finds that everyone points to everyone else. It always turns out that it must have been one of those gremlins on the night shift. So just the plain old problems of organizing the thing seems, to us as a user, to militate against a remote installation. The simple question keeps coming up: Why let humans get their fingers into the system? Why not go directly into the computer and let the all-wise monitor take care of these problems? I can tell by your laughter that no comments are needed. I don't think within the next three years we'll have a monitor system shrewd enough to do this on any computer I know about.

Finally we come to a problem which is probably the hardest of all to solve, the danger of what might be called technical stagnation. We are all trying to get the most we can out of our computers, and one way we do this is through the application of better techniques. I'm thinking now of operations as well as the applications programs themselves. It's been our experience that most people tend to become self-satisfied. They need continual jogging from other people to make use of the improvements which come along. You find out how to improve operations only by living in the installation or by being able to wander through it from time to time to see what's wrong. A remote installation off in a country club somewhere, where the operators don't seem to have to answer to anybody, would, in my opinion, lead only to stagnation. Users would do nothing but bellyache and the operators would do nothing but justify themselves. So unless you have the users fairly close to the machine, you are laying yourself open to a lack of progress.

For all these reasons, we don't think that it's a problem even worth thinking about for the next three years.

BRIGHT: I wonder if we might define more carefully what we mean by remote operation. I presume you're talking about the situation where you have both input and output equipment available, without having the large volume storage. You will have the large files of information at the centralized installation; you'll have the input and output (that is, human to machine and machine to human) at the remote location. You will have the time sequencing of the problems, presumably under program control, at the centralized location.

BEMER: What parts of the machine must be more than *n* feet away in order to qualify under this definition? Presumably, the CPU and the tapes must be centralized.

BRIGHT: I assume you mean that the human data must go to and from something, which I assume to be electrical, at the remote location. This would involve a card-reader and a printer at least.

WAGNER: Yes, that's what I'm thinking of.

BRIGHT: I assume that you're talking about mass output of data?

WAGNER: Yes.

CARLSON: Well, here's the real question. Is the guy who is using the computer punching a button which tells the machine as of that instant what to do? The way Frank described it, the man sends a problem to the computer and they, at their leisure, solve the problem and send the answer back, say, by Pony express. It seems to me this is different.

WAGNER: To be precise, and again I'm talking of the next three years, we have at the remote installation an input device; let's say that it's a card-reader. The card-reader accepts information and gets it to the computer in any one of a number of ways. The information probably gets onto tape as a buffer and it gets from the tape into the computer at the computer site. The process is reversed on the other end. Information coming out of the computer can be buffered, let's say on magnetic tape, transmitted back to the remote installation, where it can be immediately printed on a printer or again buffered by a magnetic tape for printing at leisure.

PATRICK: This is basically a closed shop operation with a gigantic central processor.

WAGNER: Yes, with 10 or maybe 15 or 20 remote input/output stations. I'm not talking about a thousand remote stations with a keyboard on everybody's desk.

TEAGER: A question that I would like to have the manufacturer's representatives answer is whether or not there is a big payoff in putting your money into one giant central computer, as opposed to several smaller computers. Presumably, there is a payoff. What is the magnitude of it? Is it a factor of 2 or 3 or more?

As a second point, I think we should look at this from the point of view of what is wrong with the way we operate rather than how we can make the way we now operate a little smoother and a little slicker. I am reasonably familiar with one computing installation, the one at MIT, and I would say that there is much that is wrong in the way we operate it. The people who should be using the computer are not, and many people who should not be using it are. Another thing wrong with it is that by the nature of present usage we tend to freeze off the very people who should be using computers. I am not going to be able to get senior scientists to sit down and write a program in FORTRAN, in the next hundred years, even if they should live that long. Right now, perhaps 5 to 10% of the MIT faculty, if I may use them as an example, are using the computer through their graduate students to solve problems, and the rest of the faculty aren't even using the machine. If we really believe that a computer is good for something besides supporting a new Parkinson's Law, then we should be asking the question, "Is there some way we can stimulate those people who are capable of using the computer as an 'intelligence multiplier' to do so?" We should face up to the fact that our present ways of using computers are not achieving this.

SWEENEY: Someone asked for comments from the manufacturers and I think the standard answer would be that "beauty lies in the eye of the beholder." Frank touched on the big problems involved in more economic use of computers dollar-wise. We haven't reached the point yet where any one computer is going to do the entire job without an awful lot of diddling around. You can't trust a monitor to be the be-all and do-all, and handle that complex end of the problem yet.

The minute you get into multiple computers, the advantages of having it all done in one place are outweighed by the advantages of having these computers scattered around. Almost immediately when you have several machines, you find it advantageous to have them located miles apart rather than to have people running around in cars or to put in a microwave link.

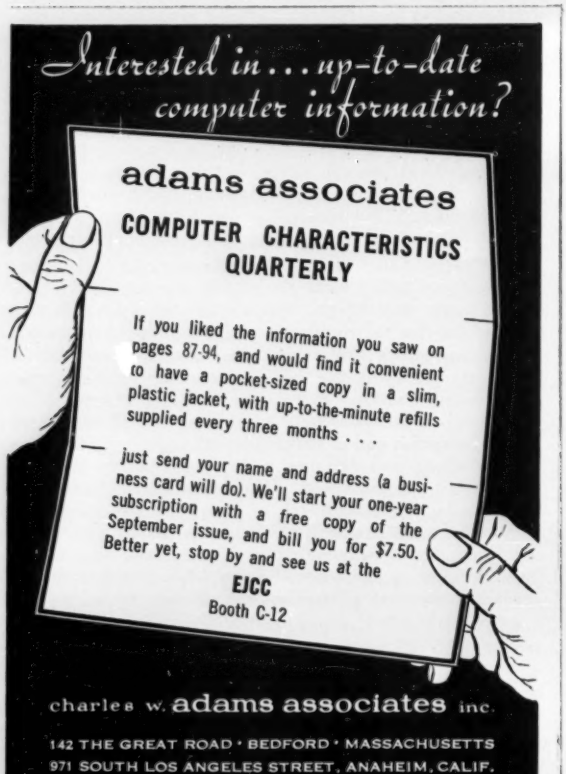
BRIGHT: Frank has touched on one problem that I'd like to spell out more completely. When you have multiple computers, you have the opportunity for a major administrative unit to have a complete installation under its control. Departmental management, with their own departmental goals, are thereby protecting themselves against the caprice of some union operating a centralized computer. They can provide themselves with executive

right-of-way. I think that people are going to be forced away from this by economic necessity, and it's a question of where those economic considerations outweigh this factor. The question of technical feasibility, of course, must be settled first. It doesn't seem to me that separating the input/output equipment from the central processor changes the basic argument. The basic question is, "Can you or can you not live with a central installation serving separate organizations?"

BEMER: This problem has to be separated as to what you really mean by remote control. As Walter pointed out, the real question is whether the remote operator really has the machine under his control and can make it start and stop at his will. We do have the other kind of remote operation where the computer is in fact in the same room, but it is under executive control and the man cannot step up and push the buttons and have the machine perform. You could, conceivably, have remote installation with a machine 50 miles away, and run it just as easily as though it were in the same room.

An analogy here might be the argument between using public transportation or driving your own car. The reason many people prefer to drive their own car is that the public transportation system runs on a fixed schedule which may not suit your needs, and moreover, if it breaks down, you're stuck. The same problem is involved in running a computer. If public power were broadcast so that you could make use of it and pay for only that which you used, it would probably be in wider use than the public transportation that we have today.

I think this is what will happen in the future with remote installations. You will need only the input/output equipment and be billed only for that time which you actually use on the central processor.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GALLER: We've run into much the same problem at our university. The question frequently comes up: "Should we have a large number of LGP-30's, with one in each department, or should we have a large central processor?" You run into a slightly different problem here; if you had five LGP-30's scattered around, each one has an upper bound on its ability to compute, and if your problem requires the computing power of the total of all five operating at once, you don't have it. We have come to the conclusion that it is far more economical to put your money into one large machine. This will satisfy everyone provided, of course, that we furnish the service. We have a very good monitor, and we can give them all the computing that they want. As it turns out then, they don't really want a computer under their own control.

WAGNER: In Galler's sense, North American has been operating pretty damned remotely for years. The people at Downey used to send their work over in boxes to Los Angeles to be computed, but in this context, I thought we were talking about a long transmission line where you were remote *deliberately* – a situation where we could have had a 7090 at Downey, but we chose deliberately, for example, to have a STRETCH located somewhere under the Los Angeles River.

ARMER: It always gets back to economics, and the question of what's available and the price of it. You've got 7090's around; you could have chosen to have LGP-30's around but one of the reasons you didn't was that they couldn't do the job you wanted to do.

WAGNER: That's right. They couldn't do 90% of the jobs whereas the 7090's can't do only 5%. I'd like to have access to a STRETCH in order to get certain problems done, but that's only 5% of the total work.

ECKERT: We tried to look into all the little bits and pieces of what we put into our computers to see if they were worthwhile putting in. We were seeking some kind of a rule for a percentage improvement in processing (which depends largely, of course, on whether it saves memory space or time) in thinking of each new feature. We find that down among the small machines, like STEP or the 1401, additions or improvements in order to be consistent with our philosophy, have to pay off at about 15 to 1. In other words, if we add something that increases cost by 1%, it has to increase preformance by 15%. You could argue, of course, that you would have to investigate whether or not, if this were continued, the increase is linear or exponential. But it's of this order. In the range of middle-sized machines, like UNIVAC III, we find that factors of 6 or 8 represent what we and our competitors are doing, and we try to get this idea around the labs so that the engineers will have a criterion by which to filter out their own bad ideas. In the larger machines like LARC and STRETCH, this number drops to around 3 or 4. Unless you are dealing with specialized machines for the military or something which has to perform in real time, you would never let this ratio get down to 1; you'd always be better off with two machines. The only exceptions would be something that had to perform in real time, as in weather prediction. Of course, in weather prediction, things have to be 10 or 100 times as good as real time to be interesting.

I don't really disagree with what is being said, at least for the next three years, but I think what will happen in the future is that we will get machines of STRETCH or LARC capability a good deal cheaper. In other words, I think the hardware can continue to go up by another factor of from 10 to 30 in speed and still stay within the price range that we have now for our machines.

LANZAROTTA: How soon, Pres?

ECKERT: Well, I can't tell whether it'll be three years

or five or six years. I could tell you who's making it possible technologically. I know who is building 2,000 megacycle transistors but I can't predict how fast it will take to make the machine. You see, there aren't enough people in this high speed business so that you extrapolate the way you might want to. There aren't so many people in this business that things act in a purely competitive fashion. You have to know who is playing leapfrog with whom to understand who is going to make the next jump in what size range. But it could be done in the next three or four years; there may be things that we would rather do instead.

WAGNER: But that would militate against centralized computing. For what we are doing today, the cost of the main frame is only 30% of the total anyway. If you cut that in half, it makes it even more economically feasible and desirable to have many computers.

ECKERT: It depends largely on whether your appetite for speed goes up or your appetite for cost reduction goes up. Which are you being pressed for, getting your computing done cheaper or getting more computing done for the same price? I think that if we assume you are trying to get work done cheaper, and not trying to get more work done for the same price, then you would go in the direction of having a central operation. Now, you might go in the direction of having several centralized computers for reasons of reliability as you outlined. Don't forget, however, that since the vacuum tubes have been replaced by transistors, that reliability of the electronic equipment has gone up by 100 to 1.

WAGNER: But the reliability of getting the work done hasn't changed at all.

ECKERT: This is largely because the reliability of the mechanical devices has not kept pace, but certain things, like the flying head drums that we use on the LARC, do represent improvements in reliability of 100 to 1 over such things as magnetic tape drives for a given quantity of data handled. So it is not unlikely that over-all system reliability will become many times more reliable than what we were accustomed to in the vacuum tube days.

I'd like to make one more comment on this idea of having one large machine rather than several small ones. If it's true that a large machine is several times cheaper, per computation, than several small ones, you could do something as crude as simply dividing time into three parts. You could then say that a third of its memory cycles belong to this portion, a third to this, and a third to that. It might be some other proportion, of course. This would at least get rid of most of the arguments about management conflict and the like. You would then be sharing equipment in much the same way as people will do with a telephone exchange. For the most part, people are not cognizant of the fact that when they are using a telephone, they are sharing equipment with other people. Of course, a good mass storage is needed rather than a group of tape units for each user.

PATRICK: I happen to have some of these numbers that we seem to be concerned with, and as Eckert pointed out, the cost of the phone line becomes significant. It happens to be that with a 407 type printer running about 1000 dollars a month, and a card-reader running about 600 dollars a month (that is a total of 1600 dollars per month), you can have a Bendix G-15 all your own for about the cost of a cross-town telephone line. This is where the trade-off comes these days because phone lines are so expensive. If you go to longer phone lines, you can get the cost down to about $1.30 per mile per month. Douglas is now using a 7090 across the country from Georgia to Santa Monica and back because the phone line in that case is cheaper than the second shift on the 7090. It's true that you can think in terms of little itty-bitty computers scattered all over, but the threshold cost of the phone lines is what makes our thinking go to 7090.

TEAGER: When you say $1.30 per mile per month, and then assert that the threshold cost lies in the phone lines, I'm confused.

PATRICK: The commercial cost of long-distance phone lines is a function of bandwidth and of distance. If you're talking about telephone line quality, you're speaking in terms of about 2400 bits per second which is about equivalent to 100 cards per minute, including some redundancy. This sort of service with General Telephone starts at about $4.20 per mile per month within Los Angeles county.

TEAGER: Then the issue is how many miles you go before it's economically unfeasible rather than the percentage of the cost.

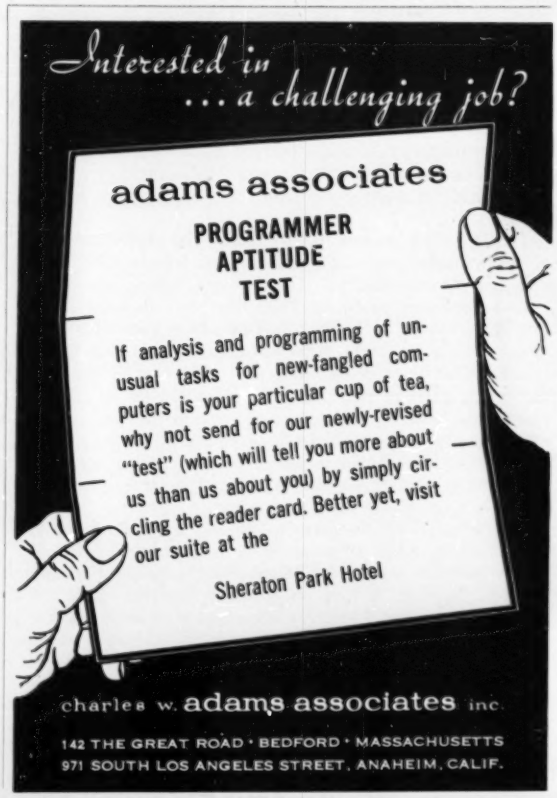
PATRICK: The rate goes down, but you have to have more and more volume to justify the over-all expenditure.

TEAGER: Now wait a minute. Four dollars per mile per month is not a large cost in relation to $1000 per month. That's certainly true if you're talking about one mile. It changes when you start talking about 2000 miles.

PATRICK: But if I'm talking about one mile, then a messenger service is a lot cheaper. There's a lot of bandwidth in a car.

TEAGER: But the response time is much greater with a motorcycle messenger, because I can't let you on the machine instantaneously. The only way to get you on instantaneously is to dedicate a G-15 to you.

TEAGER: But we seem to be talking about this problem in terms of solutions that everyone has in the back of his mind. I think we ought to drag these out and examine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them. You were apparently talking about a different solution in the back of your mind than the one I have. Now, when you're talking about telephone lines, are you talking about long-distance communication?

PATRICK: Yes.

TEAGER: With lots of card-readers and printers at each facility?

PATRICK: Well, a couple, at least. Let's say we were talking about 10 remote locations connected to a central facility right here in Los Angeles.

TEAGER: And if we assume that each of these installations averages 10 miles from the central facility, then by your own terms we're talking about $40 per month. What's killing them is the printer and card-reader at each facility.

PATRICK: You're in to it so deep, that your response is very poor. You're not going to do it with phone lines. It takes about six phone lines to handle a Collins Kineplex.

BRIGHT: Let me clarify something here. There are at least four commercially available devices which will put 2400 bits per second (that is, 150 lines per minute) on one telephone line, and this you can get for your two dollars per mile per month. Now, what will kill you is not the $1000 a month for the input/output gear, but the $5000 it's going to cost you for buffers and control equipment. If you're talking about short haul operation, you're going to have prohibitively expensive terminal equipment, but if you're talking about operations across the country . . .

PATRICK: . . . Your terminal equipment is a much smaller proportion of the total investment.

WAGNER: But let's not overlook the fact that 2400 bits per second doesn't get you much in the way of using a big machine. For example, the Douglas operation uses about five 7090 hours per week. They load the lines all day back and forth to support this.

PATRICK: This is part of the university-industry deal. The university people are living in a different world.

TEAGER: I'm not sure we're living in a different world at all. It seems to me that the industry people are talking about turning out 10 wheelbarrow loads of data that no one is going to look over.

PATRICK: That may be true, but that's what they're *doing*.

TEAGER: This sounds like someone who says, "Give me a scope display remotely, and for this I have to have a 6-megacycle bandwidth." They're just talking about an entirely different problem. There just isn't that much information needed. If they're talking about sweeping television-wise, then they will indeed need 6-megacycle bandwidth. What they really want is a collection of lines on the scope, each of which can be described by its coordinates. And now we're beginning to chop the data transmission and display problem down to size.

PATRICK: This business of compressing input and output data is a much tougher problem than trying to beat the FCC rates down.

ECKERT: It isn't necessary to do this by programming; you could store the information on a drum and you could use a slowdown video technique, for example. I think the real problem is that our present computers are not designed to accept telephone lines as one of their primary inputs. We shouldn't really need this $5000 box between the computer and the telephone line; the computer should be designed to accept information from the telephone line directly.

PATRICK: Doesn't this imply that everyone who is not contemplating hooking on a telephone line would be paying the price anyway?

ECKERT: Well, this whole concept of having a separate box for everything you want to tie into the computer is a makeshift one.

GALLER: I'd like to go back to this question of the 5% users among the people who should be using computers. I think there are several things that are keeping the other 95% away. One of these is turnaround time, another is the services you give, and the third is how easy it is to communicate.

I speak, of course, only of our experience at Michigan, but I think it can be generalized. We started, first of all, with a large educational project to educate the faculty into what computers can do. Right now, we have some 80 engineering courses which assign problems for homework which involve a computer. As a matter of fact, we do this remotely; there is a box in the Engineering Building into which people drop their problems. A messenger carries the problems over to the computer center and carries the answers back. As far as the engineering students are concerned, that box is the computer and it is highly effective.

Now in contrast, I know of one university on the West Coast in which they have stated very frankly that they are going to use their computer (a 709) to service some half a dozen very large projects. They don't want to educate the whole campus, and in this way they're going to get all the machine time that they want. They have different objectives.

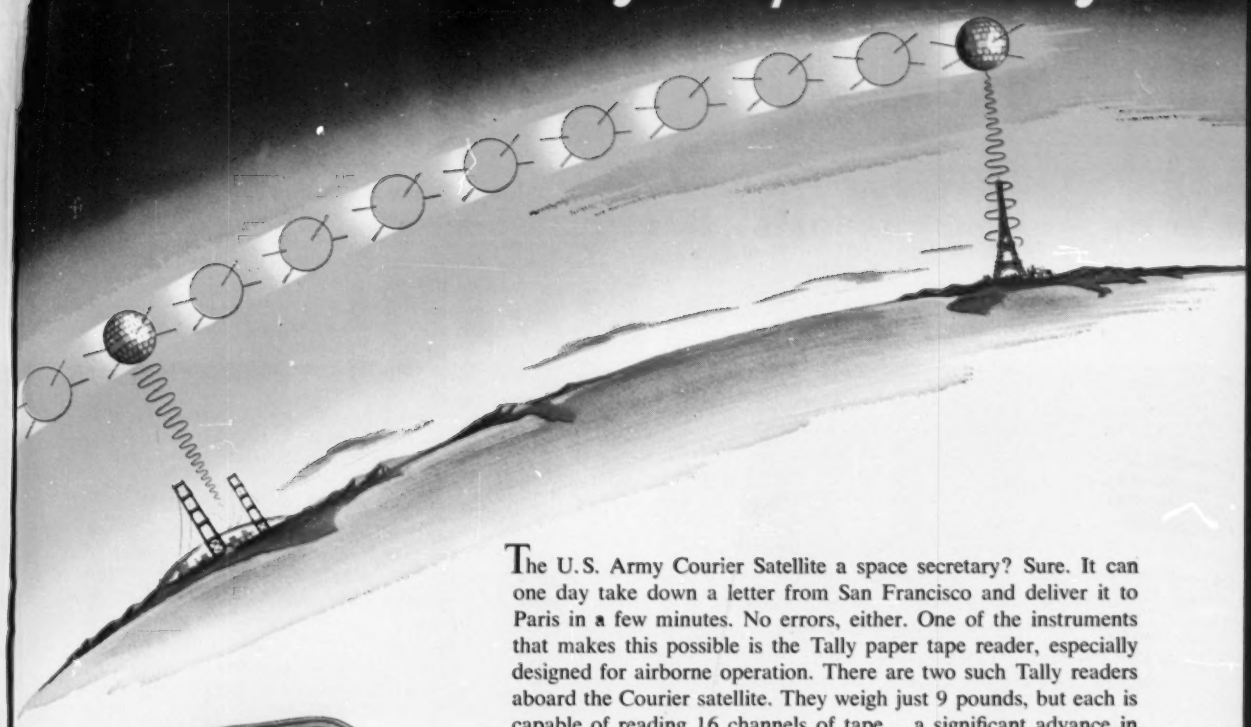
If you want the whole campus to use the computer, and you can provide adequate turnaround time and sufficient services, they will come.

TEAGER: You've pointed up the basic problems of service and turnaround time, but it doesn't seem to me that offering the kind of service where people slide their problems under the door and come back with a wheelbarrow for the answers, is going to extend the services beyond the 5% that we're talking about. A different type of communication must be provided.

BRIGHT: Earlier I made the statement that we had been singularly unsuccessful in the use of computers because we had handled only those problems which represented a dramatic gain. In effect, we had never tackled any problem which had heretofore been handled decently by hand. It occurs to me now that perhaps this is wrong. Since there are a large number of problems, for which people are screaming for solutions by machine, maybe we shouldn't all try to be heroes and get even the payroll problems running economically in our lifetime. Maybe we should try our hand at some of the as yet unsolved problems that take not smaller, but bigger operations. Maybe we should explore what has been called the ADP approach rather than mechanizing what has been done manually. Maybe we're only kidding ourselves by going after that other 95% when we're not hitting the 5% very effectively yet.

PATRICK: Maybe this is the thing that will bring about the centralized computing concept. The reason we got where we are now is that we were satisfying an unfilled need. The economic basis is just a by-product of how we're doing things. There have been things that we just could not do, like missile tests (where you're not going to get the vehicle back and you'd jolly well better simulate it). It's like building an atomic bomb in order to determine the critical mass. I don't want to sit there and push those two hunks of metal together – you don't get to do it but once. Maybe this is the kind of problem we ought to look at. I suspect that the larger business systems are in this area. In these systems they do need all of the information located centrally, and that is the type of problem that may bring about centralized computers.■

TALLY readers fly in "Space Secretary"



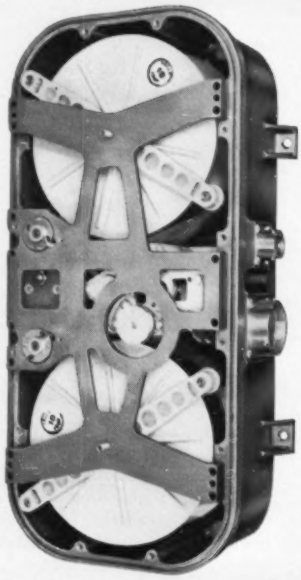
The U.S. Army Courier Satellite a space secretary? Sure. It can one day take down a letter from San Francisco and deliver it to Paris in a few minutes. No errors, either. One of the instruments that makes this possible is the Tally paper tape reader, especially designed for airborne operation. There are two such Tally readers aboard the Courier satellite. They weigh just 9 pounds, but each is capable of reading 16 channels of tape... a significant advance in the state of this particular art.

The satellite readers were built by Tally for the Western Development Laboratories of Philco Corporation, which designed and built the satellite for the U.S. Army Signal Research and Development Laboratory at Fort Monmouth, N.J.

According to Philco engineers, the simple design and reliable operation of Tally readers led to their selection for the Courier Project.

You will find the same simplicity and reliability in Tally's standard, earthbound readers. In fact, they're used in ground stations transmitting and receiving Courier messages.

Write for our tape reader literature. In the meantime, here are some interesting specs on the Courier readers to whet your appetite:



Semi-exposed view of Courier Satellite spaceborne 16-channel tape reader used in Project Courier Satellite, developed by Tally Register Corporation.

ENVIRONMENTAL

VIBRATION (NON-OPERATE) 5 cps at 2 grms to 2000 cps at 10 grms with .4 inch double amp max. (OPERATIVE) To 1000 cps at 3 g's. TEMPERATURE —40°F to +130°F. ALTITUDE 200,000 ft. or better. HUMIDITY At 95% RH 130°F. ACCELERATION 15 g's one axis 4 g's two axis.

GENERAL

WEIGHT Nine lbs., including tape. PHYSICAL SIZE 14" long, 7½" wide, 4" deep. POWER REQUIREMENTS 28v DC, 150 MA. STEPPING RATE Two steps per minute max. READING Bi-directional. SWITCHING Form C switching providing an assert or negate status of each code bit being read. Switching activated by "star wheel" tape sensors.

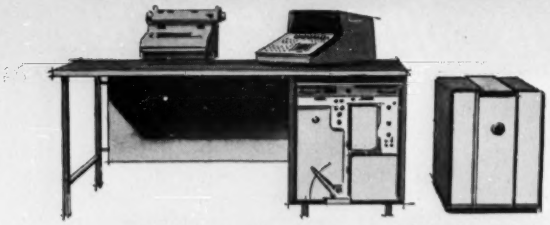
CIRCLE 15 ON READER CARD

TALLY
SEATTLE

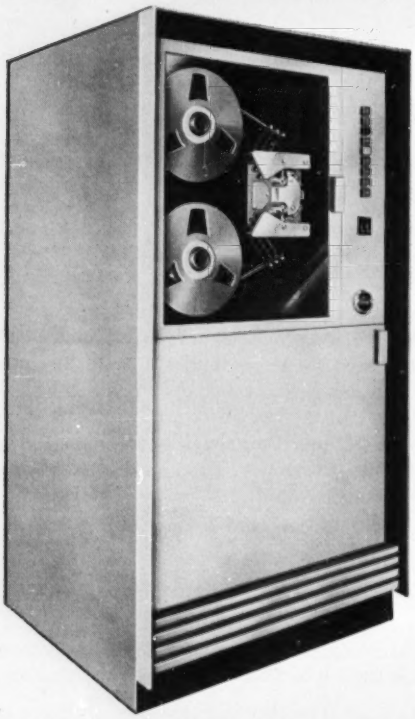
TALLY REGISTER CORPORATION
1310 Mercer Street • Seattle 9, Washington • MAin 4-0760

Come to Seattle's Century 21 Exposition, April 21-October 21, 1962

at AUTONETICS



they chose POTTER
tape transports...



for the Recomp II
computer system

This system offers the user a magnetic tape memory unit with a capacity of over 600,000 words—and four of these units can be coupled to permit a total memory capacity of over 2,500,000 words.

Key to this highly reliable memory system is the Potter Model 910 Digital Magnetic Tape Transport. This solid-state unit provides data transfer rates to 22,500 per second on ½-inch tape or 40,000 characters per second on 1-inch tape at tape speeds up to 75 inches per second. In Recomp II, the Model 910 is teamed with the transistorized Model 921A Read-Write Amplifier system, which provides flexibility to match virtually any digital tape application.

To learn more about Potter Digital Magnetic Tape Transports write today.

POTTER
INSTRUMENT CO. INC.
PLAINVIEW, NEW YORK

CIRCLE 16 ON READER CARD

MERGERS & new firms in DP

Electronic Memories, Inc., was recently formed for the development, design and manufacture of ferrite memory cores and core memory systems. The company, located in Los Angeles, is presently producing ferrite memory cores for the commercial computer industry but is planning work on cores for space and adverse environmental applications and also on memories which have low power requirements and high reliability for space systems. Trude C. Taylor is president.

CIRCLE 100 ON READER CARD

Hollander Associates, Fullerton, Calif., has been established to provide comprehensive design and consulting services in computers and control systems, and will also furnish scientific liaison services in Europe for the purpose of short presentations or investigations for several non-competing American firms. The founder, Gerhard Hollander, was formerly head of system-management and computer operations at Philco and Hughes Aircraft.

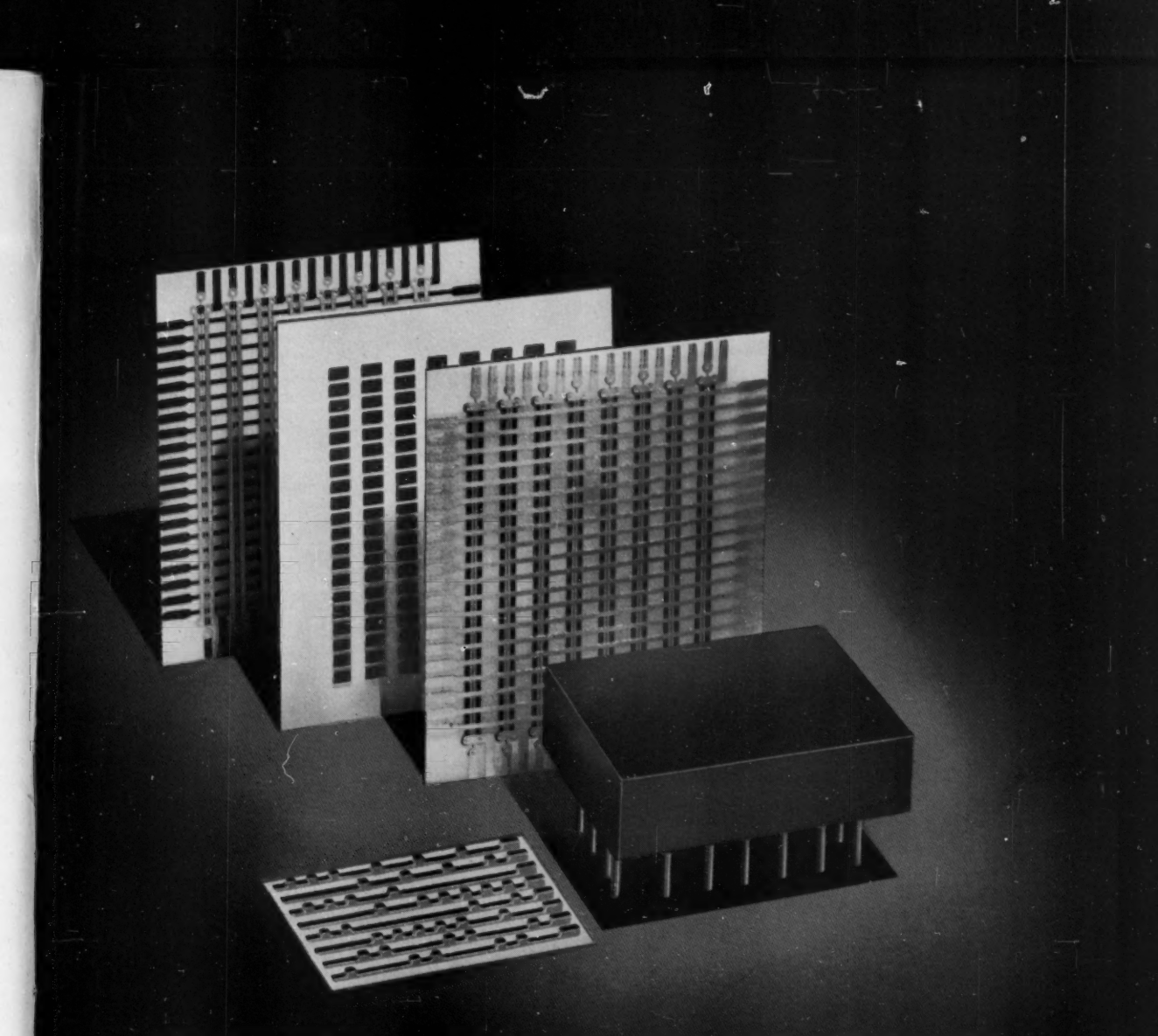
CIRCLE 101 ON READER CARD

Auerbach Corp., Philadelphia, Pa., and The Bureau of National Affairs Inc., of Washington, D.C., have entered into a joint venture to produce a comprehensive information technology service for users of edp systems. Technical analysis will be provided by Auerbach, while BNA will publish and market the information.

CIRCLE 102 ON READER CARD

The Simulmatics Corporation is a new firm which deals with a technique for social and economic research by combining advanced computer technology with studies in the behavioral sciences. Edward L. Greenfield, president, said that the company was organized exclusively to make commercially useful applications of computer simulation. The new company, with offices in New York City, was founded by several scientists, mathematicians and computer experts associated with such universities as MIT, Columbia, Yale and Harvard.

CIRCLE 103 ON READER CARD



TAKEN FROM TOMORROW

BIPCO™ Modules — Built-In-Place Components In Modular Form . . .

The Burroughs Corporation announces the commercial availability of tomorrow's techniques . . . today. BIPCO modules combine the reality of performance, low cost and immediate availability, to signal a major transition in the state of the art.

Thin Film Memory Planes and Solid State Multi-element Modules are the first of the BIPCO module family. The Thin Film Memory is capable of storing 20 words of 8 bits each for a total of 160 bits of information, and has a cycle time of 0.2 microsecond. The Solid State Module is a binary coded decimal to decimal diode converter which utilizes 40 diodes in matrix logic.

Burroughs Corporation's breakthrough in Built-in-Place Components is made possible by the unique combination of two major new techniques. First, multi-element components are simultaneously fabricated within a single device. Second, these elements are placed in a predetermined pattern in such a manner as to facilitate complex internal connections.

This combination of techniques has resulted in BIPCO Modular Devices with simple inputs and outputs which perform functions normally requiring myriads of elements and connectors.

Write for BIPCO Module Technical Brochure.

CIRCLE 17 ON READER CARD

ANOTHER ELECTRONIC CONTRIBUTION BY

Burroughs Corporation

ELECTRONIC COMPONENTS DIVISION

PLAINFIELD, NEW JERSEY

Formerly Electronic Tube Division

WE REALIZE THAT THESE POSITIONS WILL BE AD-VERTISED AGAIN NEXT YEAR!!

BECAUSE MANY OF THE PEOPLE WE HIRE NOW WILL HAVE BEEN PROMOTED.

Our H800 and H400 scientific and business computer systems have been gathering users like bees to honey. To keep the supply equal to the demand, Honeywell EDP has had to grow.

Hence, one year from now you'll probably see this ad again. Where will you be then? Still looking for a way out of your present job, or growing with Honeywell EDP?

PROGRAM SYSTEMS DIVISION

Opportunities exist for:

SENIOR ANALYSTS

Responsibilities in the Language Definition and Systems Determination Group. Analysis of the COBOL specification and the development of compiling systems for implementation. A degree in mathematics or physics is desirable, with 3-5 years' experience in Automatic Programming. Specific experience in constructing Assemblers with generators and library sub-routines is desirable.

STAFF ANALYSTS

Should have 2-4 years' experience. You will organize and direct the implementation of complex program systems such as Compilers and Assembly Routines.

PROGRAMMERS

College degree preferred. A minimum of one year's experience is required. You will write and check out portions of Automatic Programming Systems. These and other Programmer opportunities exist in the following areas: Program Monitoring Systems; Scientific Programming; Operational Programming; Service Routines.

MARKETING DIVISION

Opportunities exist for:

INSTRUCTORS

Courses are presented at our Branch Offices and at customer locations, therefore some foreign travel is possible. Must have at least one years' experience teaching EDP Programming and Systems. Willingness to travel and relocate is essential.

SALES REPRESENTATIVES

Qualified candidates should have at least one year's experience selling magnetic tape EDP systems.

SYSTEMS SERVICE REPRESENTATIVES

Requires prior experience in Programming and Systems Analysis work on tape computers.

If you are planning to attend the Eastern Joint Computer Conference in Washington, D. C., interviews may be arranged with Dr. Roger Bender, Program Systems Divisions or Mr. Donald Brosnan, Marketing Division, by contacting John L. Ritchie, Personnel Manager, at the address below.

These career assignments are available throughout the United States, particularly in the New England area. Honeywell EDP offers an excellent employee benefits program, the opportunity to continue your education and periodic salary reviews. Relocation expenses will be paid. The confidential nature of all inquiries shall be completely respected.

Honeywell

Electronic Data Processing

'An Equal Opportunity Employer'

Opportunities also exist for qualified personnel from design through programming and sales. For information, write to: John L. Ritchie, Personnel Manager, 60 Walnut Street, Dept. 140, Wellesley Hills 81, Massachusetts.

CIRCLE 302 ON READER CARD

BULL'S 300 SERIES

Sans buffer stores between units

The 300 Series Data Processing System, a product of the Bull Machine Company of Paris, has a reading and punching rate of 300 cards per minute. Printing is also rated at 300 lines per minute.

The synchronized functioning of the units composing the 300 series permits direct transmission of data without the use of buffer stores between the different units. These units are synchronized to a common speed of 300 cycles per minute.

The system completes the entire preparatory and data processing operation in a single pass using just one machine. Only card sorting is performed by a specialized machine. The reader, storages, processing and print units, controlled by the program control unit, operate simultaneously when needed.

The programming control unit contains the programming unit, comparators, memories and various commands. The program unit has 5 unit-connection points: 3 input-output points to each of which six card readers, six card reader punches, and six print units can be connected, and 2 processing unit points to which any combination of calculators with or without a magnetic drum may be connected.

The programming sub-unit contains 60 function selectors, 60 function cycles, and 30 function relays. The comparison sub-units are of three types: inequality detectors, integral comparators and matching devices.

The card reader is an input unit permitting data to be introduced from standard 80 column cards at the rate of 300 cards per minute. The reading track is divided into four main parts: the hopper, the operative part, the ejection tracks and the reception system. The movement of the cards is readily controlled from the plugboard by using the independent clutches at each station.

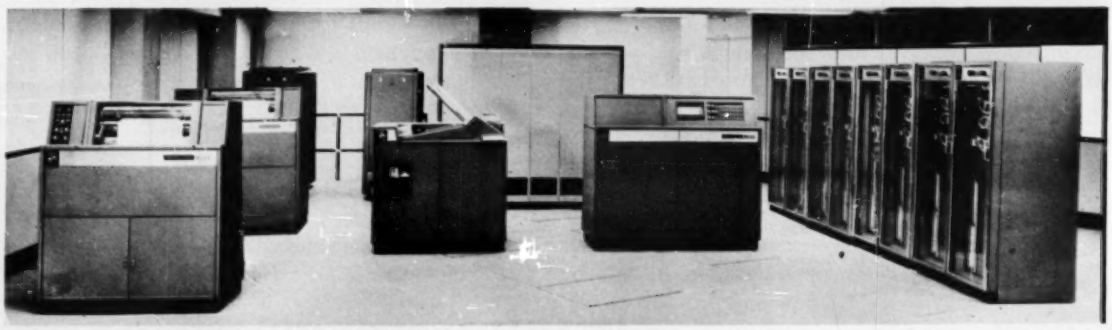
The printer can print lines of not more than 120 characters or spaces long. It prints at a rate of 300 lines per minute, when operating at maximum speed.

A magnetic drum with a storage capacity of up to 16,384 12-digit words can be integrated with the system. The drum uses the Gamma 300 as an arithmetic and logic unit. It has 64 high-speed 12-digit word stores for feeding the system with instructions from the complete set of stored instructions.

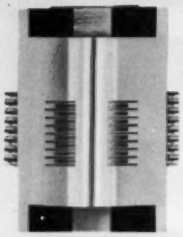
The magnetic tape used with the unit is ½ in. magnetic tape wound on 2,400 ft. reels. Information is recorded on seven parallel channels, six for the data and one for the transversal parity check digits. Information is stored in fixed length blocks of 768 bits.

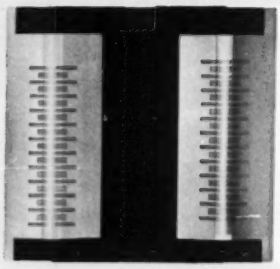
At the present time there are more than 50 of these systems contracted for outside of France. Cost is about $160,000, or a rental charge of 2 per cent for one month with purchase option entitling to a 50 per cent rebate when purchase is decided upon.

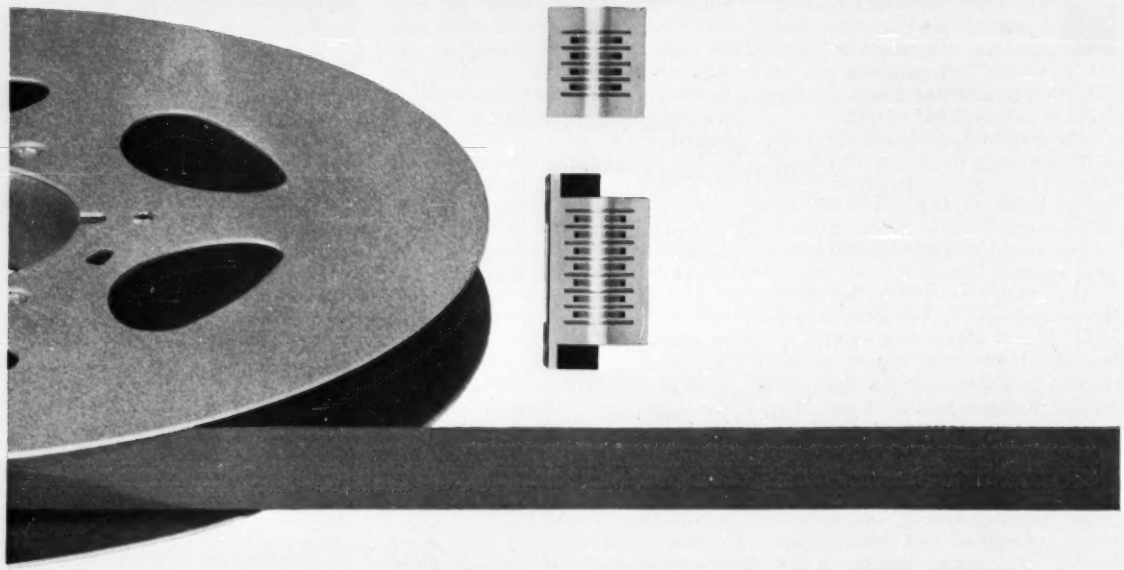
CIRCLE 119 ON READER CARD



standard heads by Brush fill 90% of all Magnetic Head Applications







Why such an all-out claim? Because only Brush has kept pace with the many design requirements in recording technology. Continuous analysis of current and future trends enables us to maintain a design improvement program incorporating all field-proven advances in our *standard* heads. It's a must . . . to satisfy *all* customer requirements. The result? We've been able to standardize and meet all but a few highly specialized applications. You save engineering and testing time . . . and money. If you're one of the few with a "special" problem, Brush obviously has the engineering capability and manufacturing facilities necessary to fulfill *your* magnetic head application. With both standard and special heads, detailed mechanical drawings and specifications plus actual electrical characteristics are available *before the fact.* You can accurately predict system performance without costly time-consuming tests. *Write now for our design and specification bulletin "Optional Characteristic Heads".*

brush INSTRUMENTS
DIVISION OF
37TH AND PERKINS CLEVITE CORPORATION CLEVELAND 14, OHIO

Announcing

STANDARD EDP REPORTS

. . . a pioneer information service for EDP users which will provide

Objective, comparative studies in depth of all computer hardware and software

This new service has been developed by AUERBACH Corporation and The Bureau of National Affairs, Inc. It has been developed because a data processing system, even for small applications, represents a massive investment in money, time and procedural readjustment—whether owned, leased or time-shared.

A data processing system can give you a powerful competitive advantage—but only if you understand and utilize it properly.

To help you thoroughly understand and effectively utilize the EDP systems now available—or in the offing—AUERBACH Corporation and The Bureau of National Affairs, Inc. are collaborating to publish a completely new kind of USER-ORIENTED professional service. *The crucial feature of this service is the inclusion of standardized performance analyses which enable you to make direct comparison of systems for specific applications.* In this way the real value of specific features is made clear.

To be known as the **AUERBACH/BNA** Standard EDP Reports, this service will examine individually all machines and programming packages commercially available in the U. S. and will supply details in these areas of information:

TECHNICAL REPORTS describing each system as a whole in standard terms and format—analyzing hardware, software, and performance. Similar analyses of peripheral equipment, independent of systems, will be included. For the first time software will be described in detail for the user.

COMPARISON CHARTS providing apple-to-apple comparisons of specifications and performance data. Separate charts present comprehensive comparisons of peripheral equipments.

SELECTION PROCEDURE REPORTS which will help you select the computer and EDP system which best suits your requirements.

GUIDELINE REPORTS which will keep you up to date on state-of-the-art trends and developments throughout the field.

AUERBACH/BNA Standard EDP Reports will be your one best source of complete operating and performance information on your present, or planned, EDP installation.

AUERBACH/BNA
Standard EDP Reports
Will Be Displayed At
BOOTH 60
During The Eastern Joint Computer Conference.
We Invite Your Inquiries And Comments.

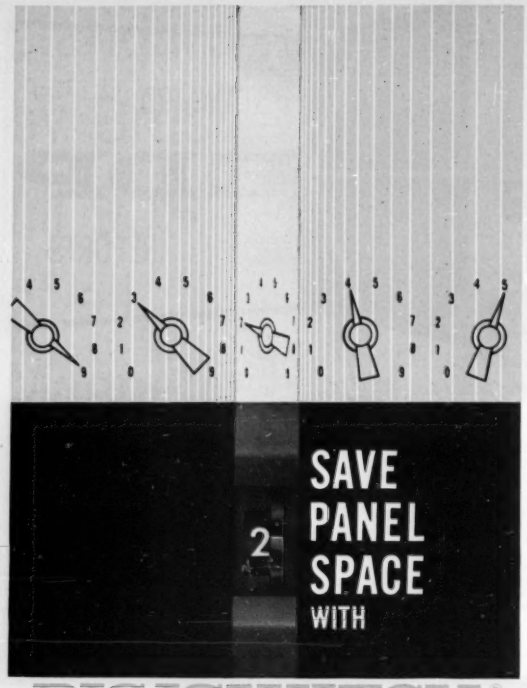
If you are unable to join us at the Eastern Joint Computer Conference in Washington, December 12-14, to get full details write Department 1200.

AUERBACH/BNA

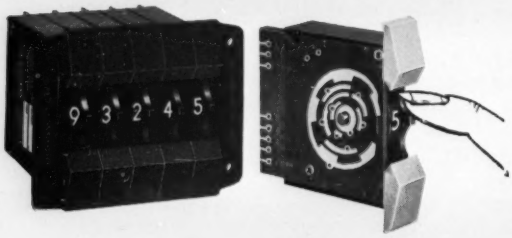
The Bureau of National Affairs, Inc.

1231 24th Street, N.W. • Washington 7, D.C.

CIRCLE 20 ON READER CARD



DIGISWITCH®



A NEW CONCEPT IN SWITCHING

- Converts directly from dial setting to computer-coded electrical outputs.
- Saves panel space and installation costs.
- Provides human-engineered operating advantages.

Write or call for technical data and a no-charge demonstration unit.

THE DIGITRAN COMPANY
660 So. Arroyo Parkway, Pasadena, Calif.
MUrray 1-9667 • Ext. 433
A division of Endevco Corporation

CIRCLE 21 ON READER CARD

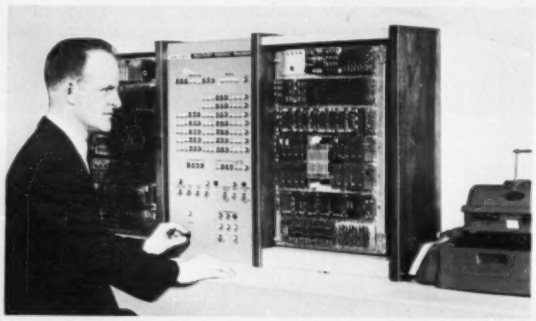
from Univac—

A DESK-TOP DIGITAL TRAINER

The Univac Military Digital Trainer, recently introduced by the Univac Military Dept., St. Paul, has applications ranging from training in computer maintenance, design and programming to the solution of many dp problems. The desk-size binary computer has several large-scale computer characteristics and includes I/O via an automatic typewriter with paper-tape reader and punch. The unit is priced at $34,500, occupies eight cubic feet of space, and operates from 60 cycle, 110V AC power, dissipating a maximum of 750 watts of electrical power.

The computer has a single address instruction repertoire with J-bit options and B box indexing, plus regular divide and multiply instructions. It also includes a core memory with 512 15-bit words of random access storage with a read-restore cycle of eight microseconds, add time of 24 microseconds, and multiply-divide time of 130 microseconds. A complete console is available with all arithmetic and control registers on the panel for operator intervention and for teaching operator procedures. Another characteristic of the trainer is solid state parallel logic circuitry with 630 logical elements which are identical to and operate at the same speeds as in the newest and considerably larger Univac computing systems.

For educational purposes, the Trainer has easy accessibility, test probes and standard logic cards which simplifies student practice of fault diagnosis, use of oscilloscope and built-in circuit tester, and replacement of plug-in circuit modules.

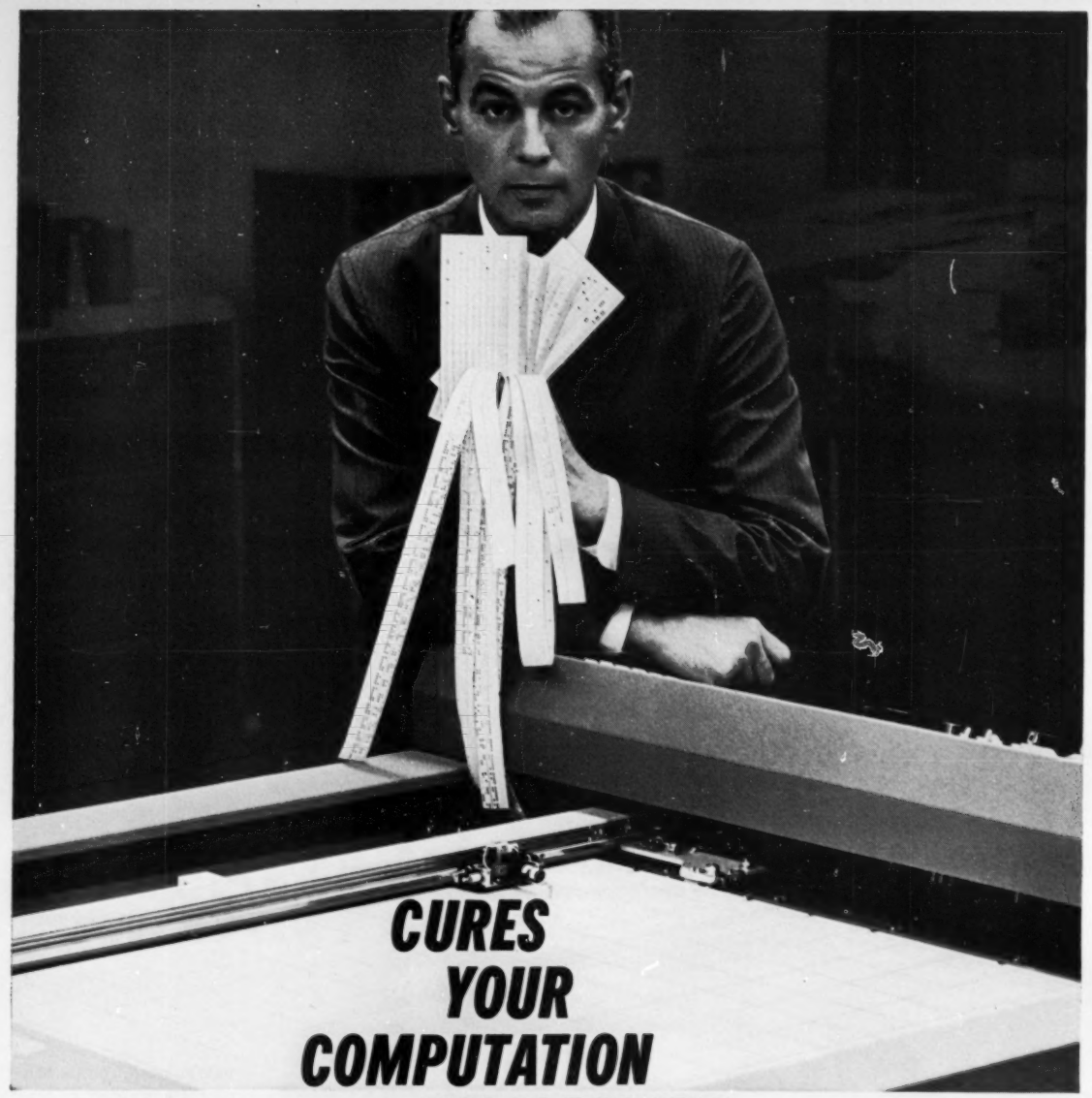


The computer can also be used in teaching dp fundamentals, and can enable the students to prepare, load, set up and initiate program tapes.

The instruction repertoire gives a machine-demonstrated method for programming courses including indexing, debugging, output data analysis, and problem definition.

Included in the selling price is a three-week training course, at the customer's site, to teach the theory, operation, programming and maintenance of the machine. Delivery of the Trainer is six months after receipt of order. ■

CIRCLE 104 ON READER CARD



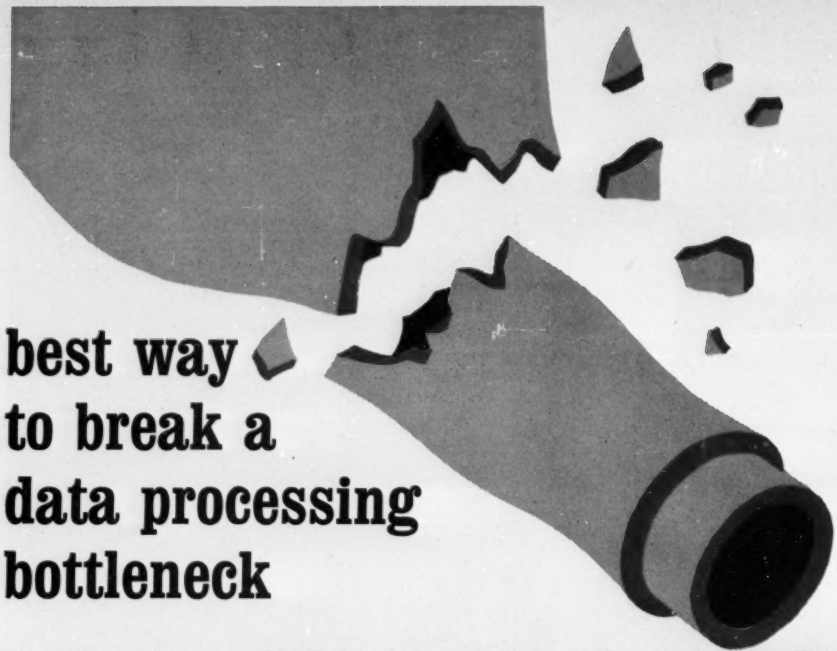
CURES YOUR COMPUTATION INDIGESTION

Here is how to reduce the overwhelmingly voluminous output of a digital computer to a useful form. You need a convenient, rapid and accurate way to plot curves and charts automatically and accurately — such as the EAI DATAPLOTTER 3300. This superb plotting machine reduces digital information to Cartesian coordinates in X and Y, in point or line, on paper size up to 30 x 30 inches. Plots up to 80 points a minute with accuracy of .05% of full scale. There are many accessories and a wide variety of other plotters if the 3300 does not fit your needs. Write for information to Dept. DA-9.

EAI ELECTRONIC ASSOCIATES, INC. *Long Branch, New Jersey*

Leader in Analogics Analog/Digital Computers Data Reduction Process Control Instruments Computation Service

CIRCLE 22 ON READER CARD



best way to break a data processing bottleneck

No words or pictures could tell the whole, great story of the new, book-size Vari-Punch portable, printing key punch machine. Just pick it up (only 5 lbs.)... take it to an information source... use it (after a few minutes of instruction)... and prove to yourself the way it saves time and cost doing on-the-job data processing.

Its applications for gathering input data at the source are limited only by your imagination. Eliminates written or typed media. Provides programmers and tabulating room personnel immediate opportunity for creating and correcting cards.

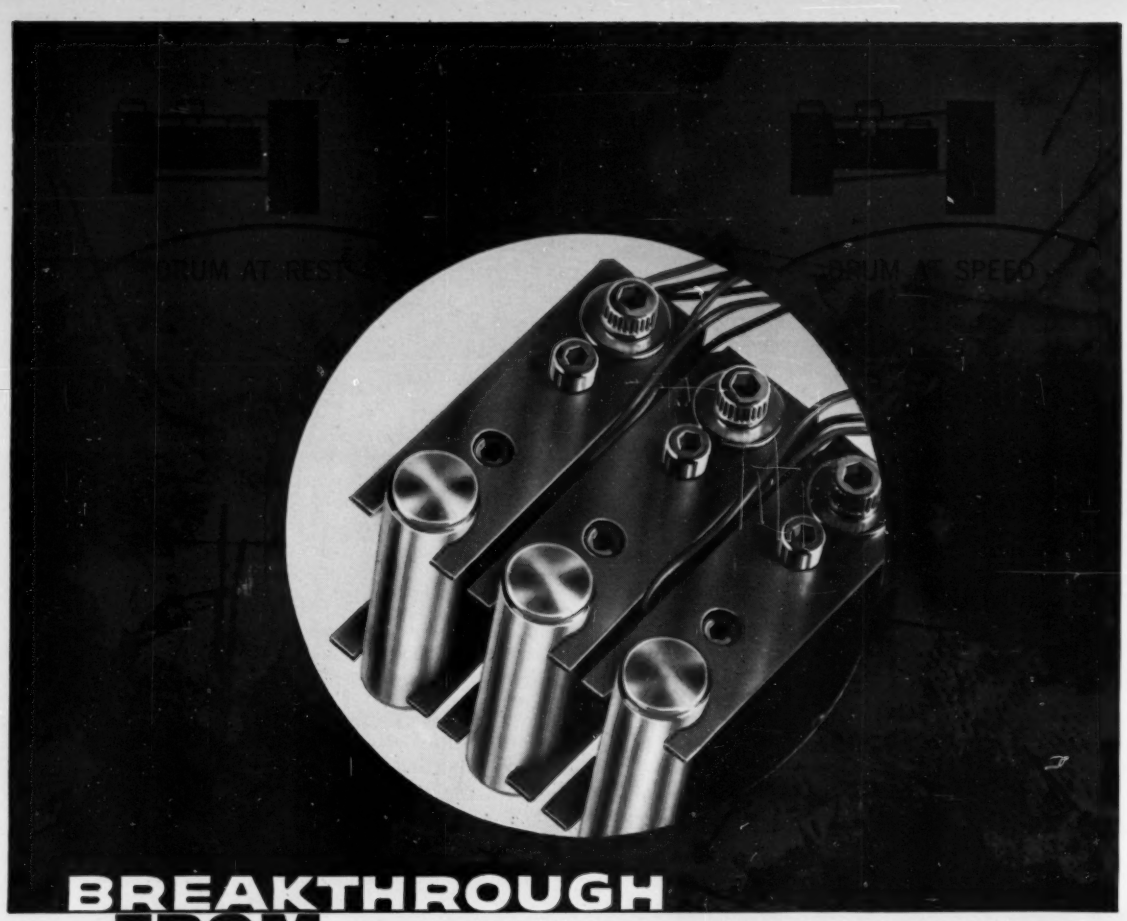
A few of its many features include... punching and/or printing of any standard 80 column card... permits programming in any field via convenient tab setting... assures accuracy via printed interpretation of punched values. Completely electric operation including keyboard.

To learn more, write us today.

VARI-PUNCH is also available in a non-printing model.

VARI-PUNCH
PORTABLE PRINTING KEY PUNCH MACHINE FOR ON-THE-JOB DATA PROCESSING

where ideas become hardware
VARIFAB, INC.
HIGH FALLS, ULSTER COUNTY, NEW YORK



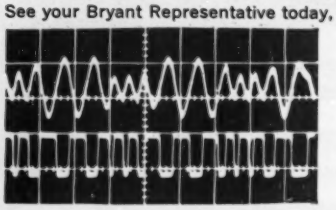
BREAKTHROUGH FROM BRYANT

NEW LOW-COST FAIL-SAFE FLYING HEADS

Now . . . at no increase in cost over previous fixed head designs . . . Bryant announces the first flying heads for magnetic drums offering complete protection from drum damage due to environmental conditions or human error. Their features include:

- Non-contact, start-stop, fail-safe design
- Improved resolution (300 bits/inch standard)
- Adjustability to match playbacks
- Unlimited recording modes
- Inductance variable to match user circuitry
- Complete head shielding for reduced crosstalk
- Increased track density (to 64 tracks/inch)

See your Bryant Representative today, or write direct.



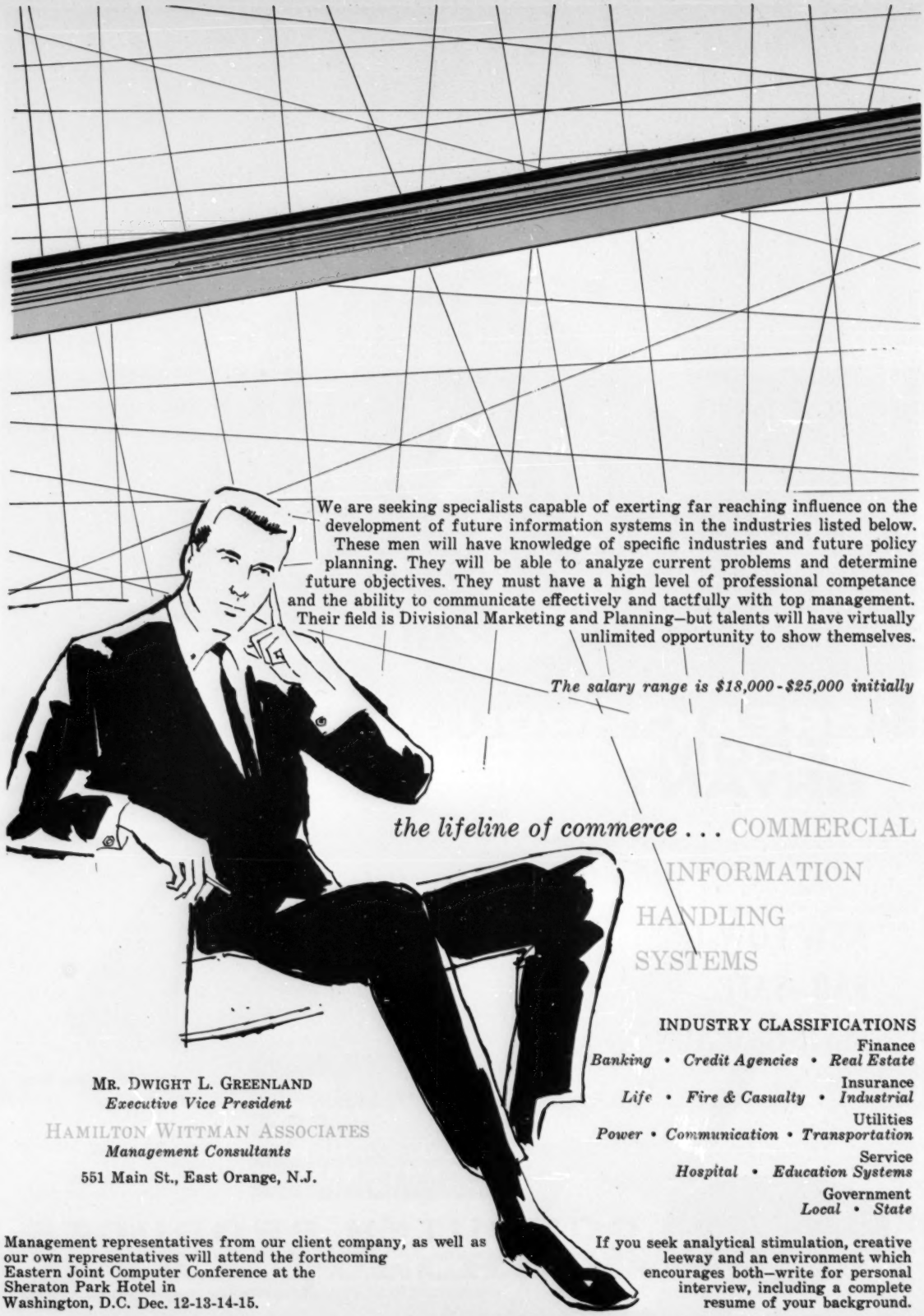
High Density Playback Wave Forms
Upper trace:
Playback at head, 50 millivolts/cm
Lower trace:
Playback from amplifier: 5 volts/cm
Conditions:
350 PPI, phase modulation,
500 KC, 1416 in/sec surface speed.

BRYANT

COMPUTER PRODUCTS

Disc File and Magnetic Drum Memories for Every Storage Application
852 Ladd Road • Walled Lake, Michigan • MArket 4-4571
A DIVISION OF EX-CELL-O CORPORATION

CIRCLE 24 ON READER CARD



We are seeking specialists capable of exerting far reaching influence on the development of future information systems in the industries listed below. These men will have knowledge of specific industries and future policy planning. They will be able to analyze current problems and determine future objectives. They must have a high level of professional competance and the ability to communicate effectively and tactfully with top management. Their field is Divisional Marketing and Planning—but talents will have virtually unlimited opportunity to show themselves.

The salary range is $18,000-$25,000 initially

the lifeline of commerce . . . COMMERCIAL INFORMATION HANDLING SYSTEMS

INDUSTRY CLASSIFICATIONS

Finance
Banking • Credit Agencies • Real Estate

Insurance
Life • Fire & Casualty • Industrial

Utilities
Power • Communication • Transportation

Service
Hospital • Education Systems

Government
Local • State

MR. DWIGHT L. GREENLAND
Executive Vice President
HAMILTON WITTMAN ASSOCIATES
Management Consultants
551 Main St., East Orange, N.J.

Management representatives from our client company, as well as our own representatives will attend the forthcoming Eastern Joint Computer Conference at the Sheraton Park Hotel in Washington, D.C. Dec. 12-13-14-15.

If you seek analytical stimulation, creative leeway and an environment which encourages both—write for personal interview, including a complete resume of your background.

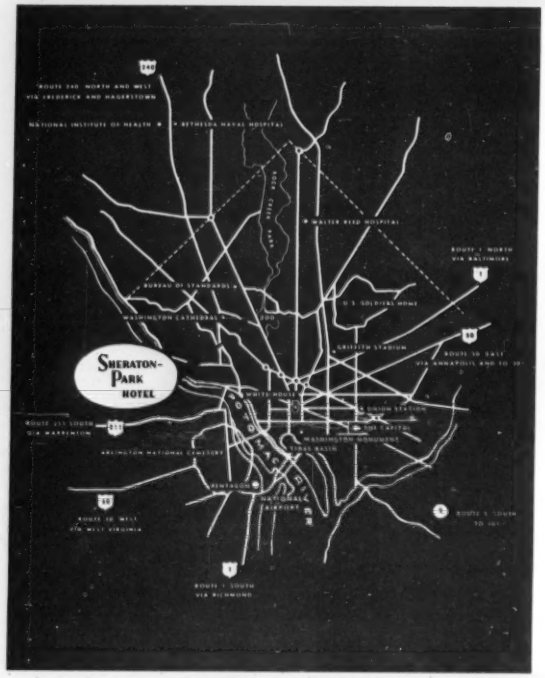
CIRCLE 78 ON READER CARD

E J computers
C C key to total
systems control

EASTERN JOINT COMPUTER ★★ ★CONFERENCE

WASHINGTON, D.C. **December 12-14**

WASHINGTON, D.C. — the locale and where to find the Sheraton Park Hotel



★★★★★★★★★★★★★★★★★★★★

EJCC PLANNERS CONFER

Officials and committee chairmen for the 1961 Eastern Joint Computer Conference developing plans for the December 12-14 conclave. Seated counterclockwise around the table in the foreground: Dr. Jack Moshman, vice-president of C-E-I-R, Inc., Arlington, Va., General Chairman of the Conference; Bruce G. Oldfield, Federal Systems Division, IBM, Washington, D.C., Chairman of the Program Committee; Paul W. Howerton, Central Intelligence Agency, Washington, D.C., Chairman of the Committee on Proceedings; Ethel C. Mardon, National Bureau of Standards, Washington, D.C., Chairman of the Women's Activities Committee; Zeke Seligsohn, IBM Federal Systems Division, Washington, D.C., Chairman of the Public Relations Committee; Solomon Rosenthal, Headquarters U.S. Air Force, Arlington, Va., Chairman of the Finance Committee; Charles Phillips, Office of the Secretary of Defense, Washington, D.C., Chairman of the Exhibits Committee.

At the far table, left to right: John Leslie Whitlock, Exhibits Manager; John Harris, Remington Rand Univac Division, Washington, D.C., Chairman of the Registration Committee; Mike Healy, Systems Development Corporation, Falls Church, Va., Chairman of the Printing and Mailing Committee; Henry S. Forrest, Chairman of the Hotel Arrangements Committee.

CHAIRMAN'S WELCOME

Jack Moshman,
General Chairman

The 1961 Eastern Joint Computer Conference will be exceptional in many respects. This meeting will be the first sponsored by the American Federation of Information Processing Societies. The technical program represents the fundamental conviction of the Committee and the underlying philosophy upon which the Joint Computer Conferences were conceived:

> *the objective of these conferences is to provide a forum for matters of interest to all individuals engaged in the computing field. The Joint Computer Conferences were not designed so that different interest groups might congregate separately and hear papers of relatively narrow scope.*

The technical program for this year's EJCC will have no parallel sessions and in addition to the formal technical papers there will be one panel discussion on the current status of programming language standardization, a topic of vital interest to all in the computing community.

As keynote speaker we are fortunate in being able to present Mr. Dause Bibby, president of Remington Rand Univac. His remarks on the theme of the meeting, "Computers – Key to Total Systems Control," will be informative and provocative.

The response of exhibitors has been overwhelming. The size of the exhibition will be over 50 per cent larger than any previous Joint Computer Conference. Many of the exhibitors are planning to show new products for the first time at this meeting.

The Conference *Proceedings* which will be provided to each registrant, will be a commercially published, hard-bound book of lasting interest.

It is hoped that many attendants at the meeting will take advantage of the opportunity to bring along their wives for a visit to Washington and its unique attractions. A full program of ladies' activities has been prepared.

It is the biased, but honest opinion of the Conference Committee that the program, exhibits, publication, social events, tours and facilities will combine to make the 1961 EJCC a most informative and enjoyable experience. ■

CONFERENCE PARTICULARS

"Computers – Key to Total Systems Control" is the theme of the 1961 Eastern Joint Computer Conference scheduled for the Sheraton-Park Hotel, Washington, D.C., December 12-14.

Sponsoring a computer conference for the first time is the American Federation of Information Processing Societies. An attendance of almost 4,000 industry delegates is expected.

Thirty-one technical papers will be presented in addition to a panel discussion Wednesday morning, Dec. 13th, on "The Current Status of Programming Language Standardization." All of the technical papers will be presented in the main ballroom of the Sheraton since there will be no parallel sessions during the conference. Subjects to be covered include "Total Systems in Real Time," "Systems Simulation," "Advances in Equipment," "Communications Systems," and "Programming and Applications."

Keynote speaker will be Dause L. Bibby, president of Remington Rand Univac. Other speakers opening the conference will include Willis Ware, president of AFIPS, and Isaac L. Auerbach, IFIPS Chairman.

The exhibit area will contain more than 11,000 sq. ft. with exhibits by 83 companies in 167 booths. The Exhibition Hall of the Sheraton will be open at 11 a.m. December 12.

On December 15, the day following the EJCC, a joint Government-Industrial Computer Orientation Conference will be staged in the Sheraton. The one-day affair is under the auspices of the Bureau of the Budget. After a 90 minute briefing scheduled for 2 p.m., government delegates may tour the EJCC exhibit hall and exhibitors are requested to remain for the additional showing.

Registration for the EJCC will be held in the lobby of the hotel and will begin at noon one day prior to the conference, December 11, continuing until 9 p.m. On the 12th and 13th, delegates will register from 8 a.m. - 9 p.m., and on the 14th, registration will be held from 8 a.m. to noon. The schedule of registration fees is as follows: $8 for member of participating societies (ACM, AIEE, IRE); $10 for non-members, and $2 for students.

A cloth-bound edition of the conference *Proceedings* will be provided without charge at registration for members and non-members. Students wishing a copy of the Proceedings will be charged an additional $1.

Social events will include a cocktail party in the Cotillion Room of the Sheraton, Tuesday, Dec. 12, the special EJCC banquet the following evening, and a luncheon on Thursday, Dec. 14. Luncheon speaker is Richard H. Scammon, director of the U.S. Census.

Four field trips have been scheduled for Tuesday evening, Dec. 12th. Other special events include a "Science Theatre" which will feature films on data processing in parallel with the technical sessions. A women's activity program has also been planned. ■

THE PROGRAM: CONCEPT & HIGHLIGHTS

Bruce G. Oldfield,
Program Chairman

The theme of this year's conference, "Computers – Key to Total Systems Control," was chosen to reflect the current trends in computer technology. There have been spectacular computer developments over the last decade: advances in hardware with increased speed, reduced size and new technologies; advances in programming, advances in the communication and display of information, and in our understanding of the man-machine relationship. Large real-time systems have as their important elements sensors for data gathering, communication, computing and display, each an integral part of a complex total system.

The sessions on real-time and communications systems present a variety of interesting and important applications in this new and exciting area. Even the discussions on hardware, programming and applications reflect the "systems concept." The session on analog and digital simulation will explore some of the current trends in this important area.

The extent of the interest in our theme was indicated by the fact that 242 papers were received for evaluation. Since there will be no parallel sessions, the program committee had an unusually difficult task in choosing from among a wealth of papers of marked technical excellence that appeared suited to our theme.

The 29 papers included in our program were selected by a screening process which was probably one of the most thorough procedures in computer conference history. The 94 reviewers and program committee members who subjected the papers to 961 reviews represented 24 organizations, and included 6 manufacturers and 8 agencies of the U.S. government. Thirteen of these organizations are based in Washington, 5 are West Coast organizations and the remaining 7 are located on the eastern seaboard. The entire refereeing process was accomplished in three weeks with an average of over 10 reviews per paper.

An innovation of this conference will be the parallel "Science Theater," a continuous showing of motion pictures on computers, data processing, mathematics and science subjects. In addition to Bugs Bunny using a computer, you will see such movies as "The Information Machine," "Introduction to Feedback," "Computer Programming," "Memory Devices," "Thinking Machines," "Communications Primer," to name just a few. The Program Committee has compiled an extensive list of movies and we do hope that you will find the extra entertainment an engaging extension of the conference.

We also hope that you will find our technical program of general interest and that you will enjoy attending the 1961 Eastern Joint Computer Conference. ■

THE TECHNICAL PROGRAM

Tuesday, December 12

AFTERNOON SESSION

TOTAL SYSTEMS IN REAL TIME

SESSION CHAIRMAN: James H. Burrows,
Mitre Corporation — Bedford, Massachusetts

MULTI-LEVEL PROGRAMMING FOR A REAL-TIME SYSTEM

A. B. Shafritz, A. E. Miller, K. Rose,
Auerbach Corporation — Philadelphia, Pennsylvania

This paper uses the vehicle of a store-and-forward communication system to describe the steps in setting up a multi-le el program for such a system. It shows how the program functions are divided into levels according to the deadlines they involve. Sequencing among the levels by programmed interruptions establishes a variable-length cycle that responds to traffic conditions to provide optimum throughput.

DODDAC—AN INTEGRATED SYSTEM FOR DATA PROCESSING, INTERROGATION, AND DISPLAY

Walter F. Bauer, Werner L. Frank,
Thompson Ramo Wooldridge, Inc. — Canoga Park, Calif.

With the DODDAC (Department of Defense Damage Assessment Center) a significant advance has been achieved in the establishment of a large-scale military data handling system which operates under real-time constraints. Of paramount importance is the integration of man to the configuration, for man-system interaction is required to elicit the information upon which decisions are based.

PROJECT MERCURY REAL-TIME COMPUTATION AND DATA-FLOW SYSTEM

S. I. Gass, W. K. Green, J. E. Hamlin, R. Hoffman, R. D. Peavey, A. Peckar and M. B. Scott, IBM, Federal Systems Division — Washington, D.C.

This paper will be presented in four sections:

The use of digital computers as an integral part of real-time decision making in Project Mercury to process observations made in the launch, orbit and re-entry phases and to supply a continuous, real-time record of the known environmental status of the spacecraft.

The Mercury programming system has been built on the modular concept whereby groups of processors which perform various tasks are combined by a monitor program.

Simulation procedures. The first method allows the operational programs to run in a quasi-real-time environment under control of a simulation program. The second method allows for the generation of a known set of data processed in real-time by the operational programming system.

Data flow and equipment configurations are unique from the standpoint of processing high and low speed data transmissions of extreme distances involving computer to computer, computer to special displays and real-time data sources to computer.

THE SATURN AUTOMATIC CHECKOUT SYSTEM

J. Heskin, Packard Bell Computer Corporation —
Los Angeles, California

The checkout procedure for the booster stage of the Saturn vehicle is being automated through the use of a computer-controlled, real-time, closed loop system. An expandable multi-computer net allows for the simultaneous running of several test programs for a number of test stations when the vehicle is checked out. More than one vehicle can be accommodated at different stages of checkout.

Wednesday, December 13

MORNING SESSION

SYSTEMS SIMULATION

SESSION CHAIRMAN: Jack E. Sherman,
Lockheed Aircraft Corporation — Sunnyvale, California

and

PROGRAMMING LANGUAGE STANDARDIZATION — A PANEL DISCUSSION

MODERATOR: Herbert S. Bright,
Philco Corp., Willow Grove, Pa., formerly with
Data Processing Group,
BEMA — New York, N.Y. & Chairman ASA X3 Committee
(Computers and Data Processing)

A SIMULATION MODEL FOR DATA SYSTEM ANALYSIS
Leon Gainen, The Rand Corporation – Dayton, Ohio
This paper discusses a generalized data system model and describes a technique of simulating dynamic system operation. Benefits possible through such simulation are explored. The major purpose presently proposed for this analytical technique is to test the feasibility of a data system design before acquisition of actual hardware.

A GENERAL PURPOSE SYSTEMS SIMULATION
Geoffrey Gordon, IBM Advanced Systems Development Division – Yorktown Heights, New York
The paper discusses a general-purpose program that is being used to carry out simulation studies of systems on a digital computer. The principles upon which the program is based are discussed and a description of the program operation is given.

USE OF A COMBINED ANALOG-DIGITAL SYSTEM FOR RE-ENTRY VEHICLE FLIGHT SIMULATION
Dr. Allan Wilson, General Dynamics, Astronautics – San Diego, Calif.
Problems of computer synchronization and control, operating procedures, and results of the simulation will be presented. The problem of error analysis, and the study of simple but definitive test cases for closed loop simulation will also be discussed.

COMBINED ANALOG-DIGITAL SIMULATION
Arthur J. Burns and Richard E. Kopp, Grumman Aircraft Engineering Corporation – Bethpage, New York
A missile intercept problem has been solved using analog-digital simulation. Dynamic equations are solved on the analog computer, while guidance and kinematic equations are solved simultaneously on an IBM 704. Advantages of this type of simulation are illustrated by comparing the accuracy and computing time of the combined analog-digital solution with those of an all-digital and all-analog solution.

CONTRANS—(CONCEPTUAL THOUGHT RANDOM-NET SIMULATION)
David Malin, Walter Johnson High School – Rockville, Maryland
CONTRANS is a computer simulation of a physiologically-oriented reasoning and problem solving model. It utilizes semi-random nets to recognize sensory patterns, attempts to create and manipulate meaningful assemblies of data and to modify its own potential for handling future data. Besides several layers of semi-random nets, the model employs a screen-like memory and representation medium, and several motor functions controlling scanning of the memory.

THE CURRENT STATUS OF PROGRAMMING LANGUAGE STANDARDIZATION: A PANEL DISCUSSION
Moderator:
H. S. Bright, Philco Corp., Willow Grove, Pa., formerly with Data Processing Group, BEMA, Chairman ASA X3 Committee (Computers and Data Processing)

Panel Members:
C. A. Phillips, Department of Defense – Washington, D.C. – Chairman, CODASYL Executive Committee
A. J. Perlis, Carnegie Institute of Technology – Pittsburgh, Pennsylvania, Chairman, ACM Language Committee
R. E. Utman, Remington Rand Univac, New York City – Chairman Pro Tempore, ASA Subcommittee X3.4 (Langauges)
R. F. Clippinger, Minneapolis-Honeywell, EDP Division, Wellesley Hills, Massachusetts – Chairman, ISO/TC 97 Working Group (Languages)

English-based COmmon Business Oriented Language has already been implemented, or soon will be, in processors for most of the U.S.-built commercially-available computers widely used for business data processing, and for several machines of foreign manufacture; ALGOrithmic Language, or dialects of it, for many engineering-scientific machines here and abroad.
ASA Subcommittee X3.4 is working in the U.S., ISO/TC 97, internationally, toward development of generally-acceptable standards in the area of programming languages.
The speakers hold responsible offices in the several organizations concerned and will provide an authoritative snapshot of computer programming language standardization as of December 1961.

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EXECUTIVE SEARCHES - INDUSTRIAL RELATIONS - PSYCHOLOGICAL TESTING

EJCC, 1961

Mr Engineer:

Welcome to the Bennett hospitality suite at the Sheraton Park Hotel!

Our staff will be available each day of the show from 9 am to 9 pm to interview you for top-flight jobs with recognized national companies.

Representatives from some of these companies will be present in our suite, to discuss their job opportunities, and they are authorized to make "on-the-spot" offers!

Should you be unable to visit us at the show, send your resume to our home office where it will be referred to our client companies in the geographical areas you designate anywhere in the United States, or overseas.

All of our services are paid for by our client companies. You are never under any financial obligation to us. Naturally all information is held confidential.

We'll be looking for you!

Cordially,

Robert E. Wallace
President

P.S. See our ad on page 63 with sample job listing.

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CIRCLE 79 ON READER CARD

Wednesday, December 13
AFTERNOON SESSION

ADVANCES IN EQUIPMENT
SESSION CHAIRMAN: Dr. Samuel N. Alexander, National Bureau of Standards — Washington, D.C.

DIGITAL TO VOICE CONVERSION
Evan Ragland,
Motorola, Inc. — Military Electronics Division — Chicago, Illinois

The conversion method uses photographic memory for the storage of a vocabulary of one to several thousand words. The photographic word is projected onto an electrically charged photosensitive plate for electrostatic readout. The vocabulary is optically scanned at a rate sufficiently high to provide access to any given word in a time imperceptible to the listener.

CRAM (CARD RANDOM ACCESS MEMORY): FUNCTIONS AND USE
Leon Bloom and Isador Pardo, National Cash Register Company, Electronics Division — Hawthorne, California
William Keating and Earl Mayne, National Cash Register Company, Data Processing Systems and Sales — Dayton, Ohio

This paper will discuss the specifications of the NCR 315 CRAM system, its application and the programming packages designed for its use. CRAM's time-efficiency performance factors, its uses in file maintenance (random, serial selective and "father-son") as well as sorting will be outlined.

THE LOGIC OF THE FC-4100 DATA PROCESSING SYSTEM
W. A. Helbig, A. Schwartz, C. S. Warren, W. E. Woods, H. S. Zieper, Radio Corporation of America, Data Systems Division — Van Nuys, California

A general purpose multiprogram computer has been designed by RCA capable of handling up to 16 different programs on a sophisticated priority interrupt basis. Each instruction, in addition to performing a conventional operation, may be used to test results for control of short program loops without requiring additional program steps or execution time.

VERSATILE MAN-MACHINE COMMUNICATION CONSOLE
R. Green, Auerbach Corp., Phila., Pa. and P. Lazovick, J. Trost and A. W. Reickford — RCA Astro-Electronic Products Division — Princeton, New Jersey

This paper describes a unique man-computer communication and buffering console which allows individuals not trained in machine language to use a computer directly. Translation and machine-language editing are controlled by the console and the time differential between a man's actions and a computer's responses are automatically buffered.

DATAVIEW — A GENERAL PURPOSE DATA DISPLAY SYSTEM
R. L. Kuehn — Aeroneutronic, Division of Ford Motor Company — Newport Beach, California

In the DATAVIEW system digital signals originated by a central computer are translated with extreme precision and high resolution to multicolored displays of either alphanumeric or graphical content. The methodology of accomplishing this transition to both console size and large screen displays is discussed.

A COMPUTER FOR DIRECT EXECUTION OF ALGORITHMIC LANGUAGES
James P. Anderson — Burroughs Corporation — Paoli, Pennsylvania

Hardware recognition and interpretation of the various syntactic elements occurring in the string of symbols making up a program, is through the use of push-down lists for the various classes of elements; control, operators, and variables. An address table is employed that relates a variable name (identifier) to a value in a data memory, as well as permits the arbitrary re-use of variable names as specified by the definition of the language.

EDDYCARD MEMORY—A SEMI-PERMANENT STORAGE
T. Ishidate, S. Yoshizawa, K. Nagamori—Nippon Electric Co. Limited — Kawasaki, Japan

The Eddycard memory is a semi-permanent memory device similar to the Unifluxor in principle. However, phenomena are observed from the other point of view, analyzing eddy current distributions in a conductor. Besides the theoretical analysis, an experimental Eddycard memory with capacity of 1,024 words of 45 bits each is introduced in detail.

Thursday, December 14
MORNING SESSION

COMMUNICATION SYSTEMS
SESSION CHAIRMAN: Jack Strong, C-E-I-R, formerly North American Aviation — Los Angeles, California

DIGITAL DATA TRANSMISSION: THE USER'S VIEW
Justin A. Perlman, Modal Systems, Inc., La Jolla, Calif.

In July 1960 members of eight major firms in the aerospace industry met to establish an informal Data Transmission Study Group. Objectives of the group were established as exchange of knowledge, standardization of terminology, discussion of total systems requirements, development of reasonably uniform requirements for equipment and service, forecasting of long range needs, and acting as a coordinating group for these users with the common carriers and equipment manufacturers.

This paper will describe the group's results to date in developing composite requirements for intra-plant and interplant data collection and transmission systems. Both wireline and microwave systems are included. Projects scheduled for completion in the near future will also be discussed.

TELEPROCESSING SYSTEMS
J. D. Shaver — IBM — Data Systems Division — White Plains, N.Y.

The background of development in data transmission devices will be discussed as well as new developments in data handling. Emphasis will be in the data communications area, stressing the business machines suppliers' attempts to provide equipment compatible with existing and future transmission services and that will also satisfy the operational requirements of the user.

COMMUNICATIONS FOR COMPUTER APPLICATIONS
A. A. Alexander — American Telephone and Telegraph Company — New York, New York

The major considerations that are involved in determining the type and extent of communications that may be used such as cost, speed, time value, availability and reliability are discussed. Some of the newer communications facilities are described and some thoughts are presented as to the possible future systems applications of communication to computer.

INFORMATION HANDLING IN THE DEFENSE COMMUNICATIONS CONTROL COMPLEX
T. J. Heckelman and R. H. Lazinski — Communications Systems Division, Philco Corporation — Fort Washington, Pennsylvania

The Defense National Communications Control Center (DNCCC), recently installed in Washington, is the nerve center of the Defense Communications Control Complex. It provides a real-time on-line system for control and supervision of the world-wide Defense Communications System (DCS), made up of the major military long-haul communications facilities. The flow of information through the system is reviewed in detail, with special emphasis on digital data interchange between communications, computer, and displays.

AN AUTOMATIC DIGITAL DATA ACQUISITION SYSTEM FOR SPACE SURVEILLANCE
Marvin S. Maxwell — U.S. Naval Weapons Laboratory — Dahlgren, Virginia

An automatic space surveillance system is being developed to detect and determine the orbital elements of unannounced non-cooperative satellites. Digital data from many remote stations is sent continuously at 2,500 bits per second to a central assembly system. Selected data is assembled into a form for entry via a tape channel into 7090 with a maximum delay of one second for on-line processing.

FOUR ADVANCED COMPUTERS — KEY TO AIR FORCE DIGITAL DATA COMMUNICATION SYSTEM
R. J. Segal, H. P. Guerber — RCA — Electronic Data Processing Division — Camden, New Jersey

Four computers of advanced design play a central role in the world's largest and most advanced Digital Data Communications System, ComLogNet. The system will initially link 240 Air Commands and other installations. The paper describes how the data communications function is automated. Photographs and a description of the hardware, stressing the unique role of the computers, are presented.

Thursday, December 14
AFTERNOON SESSION

PROGRAMMING AND APPLICATIONS
SESSION CHAIRMAN: Charles A. Phillips,
Department of Defense — Washington, D.C.

THE ATLAS SUPERVISOR

T. Kilburn and R. B. Payne — The University of Manchester — Manchester, England

D. J. Howarth — Ferranti Limited — London, England

All activities of the Atlas computer are controlled by the supervisor programs within the computer. Basic protection is provided by hardware but complete protection is provided by the routines themselves. Overall control of jobs is designed to maintain the highest possible activity of all parts of the computing system.

A SYNTAX DIRECTED GENERATOR

S. Warshall — Computer Associates, Inc. — Woburn, Massachusetts

A novel technique of compiler organization permits tabular description of not only the source language, but also the target machine. A short, universal algorithm — independent of both language and machine — uses instances of such tables to effect translation. The unusual organization of the compiler makes it a useful tool in the translation of languages which are not completely formal, and also permits very inexpensive embedding of the compiler in an overall programming system.

AN AUTOMATED TECHNIQUE FOR CONDUCTING A TOTAL SYSTEM STUDY

A. O. Ridgway — IBM — Federal Systems Division — Bethesda, Maryland

The automated study technique facilitated systems analysis by: automatically relating significant data, providing thorough analyses of existing systems, simplifying documentation correction, and automatically preparing flow charts. The study technique is completely independent of the data processing complex being analyzed, the organization involved, the mission it supports, and hardware considerations.

DISPLAY SYSTEM DESIGN CONSIDERATIONS

R. T. Loewe and P. Horowitz — Aeronutronic, Division of Ford Motor Company — Newport Beach, California

Several significant system concepts and human engineering factors related to display systems are discussed. These include: amount of information displayed, group versus individual displays, response times, retinal resolution, display detail and size, audience configuration and viewing environment.

ABSTRACT SHAPE RECOGNITION BY MACHINE

M. E. Stevens — National Bureau of Standards — Washington, D.C.

Graphic pattern recognition in development of total systems for information selection and retrieval is considered. A machine model for abstract shape recognition is described. Examples are given of recognition of 15 to 20 categories of geometric shapes. Using a contour-projection principle, the model identifies various graphic patterns, regardless of size and locational transformations.

COPS—CHRYSLER OPTICAL PROCESSING SCANNER

D. N. Buell — Chrysler Corporation — Centerline, Michigan

A character recognition system is described which incorporates a lens-and-retina input and a relatively simple computer. The system operates effectively with the image focused anywhere on the retina and may operate so as to be independent of image orientation.

TECHNIQUES FOR THE USE OF THE DIGITAL COMPUTER AS AN AID IN THE DIAGNOSIS OF HEART DISEASE

C. A. Steinberg and W. E. Tolles — Airborne Instruments Laboratory — Deer Park, Long Island, New York

A. H. Freiman, M.D. — Memorial Sloan-Kettering Cancer Center — New York, New York

C. A. Caceres, M.D., and S. Abraham — United States Public Health Service — Washington, D.C.

A pattern recognition program for automatically recognizing clinically useful parameters from physiological waveforms of the heart has been successfully developed. These parameters were then combined into a multi-dimensional probability distribution. Different distributions were formulated and stored in the computer for normal and pathological groups of patients. The compatibility of a patient's parameters with those stored in the computer was calculated and can be used as a diagnostic aid.

BENNETT ASSOCIATES

EXECUTIVE SEARCHES - INDUSTRIAL RELATIONS - PSYCHOLOGICAL TESTING

PATTERN RESEARCH SCIENTIST — **TO $20,000**
To determine and analyze the invariant and synergistic characteristics of various types of patterning leading to the development of specializing equipment capable of recognizing various unique patterns. Skilled in the mathematical sciences as well as in the application of analytics to equipment design.

INFORMATION THEORY SCIENTIST — **TO $20,000**
Experienced in mathematical formulation and analysis of various types of information processing techniques including a familiarization with basic information theory as applied to data correlation techniques.

ARTIFICIAL INTELLIGENCE SCIENTIST — **TO $20,000**
Experienced in the theory of neural nets and the simulation of artificial neurons. Exp'd. in the area of cognitive and adaptive systems as applied to the area of neural nets.

COGNITIVE SYSTEMS SPECIALIST — **TO $20,000**
Experienced in the area of servo feedback theory and design and capable or doing conceptual systems research in the area of cognitive systems.

DATA CORRELATION SPECIALISTS — **TO $20,000**
Experienced in basic information theory plus application of this theory to various types of data correlation techniques. Capable of applying these basic correlation techniques to various types of advanced guidance and intelligence data handling systems.

ADAPTIVE SYSTEMS SPECIALIST — **TO $20,000**
Experienced in the area of punish-reward type systems. Capable of doing design and checkout work in the area of "thinking" machine design and development.

SECTION HEAD — **TO $19,000**
Head Digital Computer Lab. & supervise up to 30 engineers in digital logic circuits.

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BS or MS in Math/Physics in Engineering plus min. 3 yrs. exp. in systems analysis, program writing and computer operation.

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SCIENTIFIC PROGRAMMERS — **TO $15,000**
Graduate work in Math & Engineering and a BS in Physical Science. Should have completed a course of #704, 709; 7090; 501; or 601. Programming and systems analysis plus creation of a mathematical model for implementation of systems and equipments by digital computers.

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For design of industrial process Control Programs. Excellent opportunities in the initial design phases of programs for use in the chemical, plastic, electronic, and steel industries.

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Min. 2 yrs. college plus 4 yrs. in technical or allied publication reports, proposals and brochures.

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To maintain existing business and develop new customers for the company's services and skills in the areas of Systems Engineering, Equipment Development, Programmed Teaching, and Product and Market Planning. This man will develop a marketing program and direct the efforts of the Sales Staff to achieve the goals established. He will guide the preparation of an advertising sales campaign.

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CIRCLE 80 ON READER CARD

17-YEAR-OLD TO ADDRESS EJCC ON NEURAL SIMULATION

David Malin, a 17-year old from Bethesda, Md,, who has already achieved wide recognition for his scientific abilities, will become the youngest delegate ever to present a paper before a general session of a joint computer conference. On December 13th he will address 4,000 of the data processing industry's leading representatives assembled in the Sheraton Park Hotel in Washington, D.C., for the 1961 Eastern Joint Computer Conference.

Malin's paper, "CONTRANS – Conceptual Thought, Random-Net Simulation" will be part of the "System Simulation" session of the EJCC. This research, an attempt to integrate the principles of heuristic programming with those of neural net simulation, is the result of two years of study.

The research project represented by the paper came about as the result of a recent series of large-scale educational programming courses, initiated by the Washington, D.C. Chapter of the ACM. The courses were organized and directed by ACM National Educational Chairman George Heller.

Malin participated in the initial experimental course, "Introduction to High Speed Digital Computation," employing the 709, and was one of 12 students selected for an advanced course utilizing the University of Maryland's classroom facilities and its 1620. He is now taking further ACM courses in computer theory.

"CONTRANS," however recent its formulation, is backed by four years of related scientific inquiry which gained the Maryland youth a summer research assistantship at the University of Maryland, recognition by the Smithsonian Institution, a successful patent search and top honors in two successive County-wide science fairs.

Malin first became interested in automata early in his junior high school years and soon after designed his first project – a self-steering auto operating on feedback principles – which won honorable mention in the Montgomery County, Maryland, science fair.

One year later, as a ninth grade student, Malin successfully developed an electrical information processing machine capable of word-by-word translation of English into Latin and Russian. This invention, which won First Prize in the Montgomery County science fair, was placed on exhibit in the Smithsonian Institution.

Added recognition came to Malin the following year when he again entered the science fair, this time with an optical character reading system. In addition to First Prize in the high school competition, he won the U.S. Navy's Science Cruise Award and honorable mention in the National Future Scientists Award competition.

His studies in character recognition eventually led Malin into the theoretical investigation of the human brain and nervous system, thus forming the point of origin for "CONTRANS," defined by the author as "a computer simulation of a physiologically-oriented reasoning and problem solving model." ■

★★★★★★★★★★★★★★★★★★★★

FOR THE WIVES

While delegates confer at the 1961 EJCC, their wives will enjoy a planned program of activities designed to make their stay in the nation's capital a memorable one.

The Women's Activities Committee, headed by Ethel C. Marden, National Bureau of Standards, has lined up an impressive schedule of get-togethers, entertainment events and tours.

Tuesday, December 12th, will be "Get Acquainted Day" for the wives, and will begin with a luncheon at the Sheraton Park. A brief sightseeing tour will be featured in the afternoon followed by a cocktail party in the hotel's Cotillion Room Tuesday evening.

On Wednesday the ladies will once again be feted at a luncheon at the hotel, to be followed by a theater party in the afternoon. Then they may join their husbands Wednesday evening for the special EJCC Banquet at the Sheraton Park.

To top off their stay on Thursday the wives will get a real taste of Washington through specially arranged sightseeing tours. These will include visits to historic national shrines and monuments in and around the capital, and to several of the foreign embassies on Washington's "Embassy Row." ■

EXHIBITORS' LOCATIONS

★★★★★★★★★★★★★★★★★★★★★★★★★★

CHARLES W. ADAMS ASSOCIATES, INC. C-12
142 The Great Road
Bedford, Massachusetts

AERONUTRONIC C-19,C-20
DIVISION OF FORD MOTOR COMPANY
Electronics Operations
Ford Road
Newport Beach, California

AMERICAN SYSTEMS, INC. B-2
1625 East 126th Street
Hawthorne, California

AMERICAN TELEPHONE & TELEGRAPH COMPANY 3,4,5
LONG LINES DEPARTMENT
32 Avenue of the Americas
New York 13, New York

AMP, INC. 102
MAGNETICS DIVISION
Eisenhower Boulevard
Harrisburg, Pennsylvania

AMPEX COMPUTER PRODUCTS COMPANY . 89,90,91,92
P.O. Box 329
Culver City, California

ANELEX CORPORATION 99,100
150 Causeway Street
Boston 14, Massachusetts

APPLIED DYNAMICS, INC. 42
2275 Platt Road
Ann Arbor, Michigan

AUDIO DEVICES, INC. B-7
444 Madison Avenue
New York 22, New York

AUTONETICS 61,62
DIVISION OF NORTH AMERICAN AVIATION, INC.
9150 E. Imperial Highway
Downey, California

BENDIX COMPUTER DIVISION F-10,F-11,F-12
5630 Arbor Vitae Street
Los Angeles 45, California

BOONSHAFT & FUCHS, INC. B-8
Hatboro, Pennsylvania

BRYANT COMPUTER PRODUCTS . 43,44
850 Ladd Road
Walled Lake, Michigan

THE BUREAU OF NATIONAL AFFAIRS, INC. 60
1231 24th Street, NW
Washington 7, D.C.

AUERBACH ELECTRONICS CORPORATION 60
1634 Arch Street
Philadelphia 3, Pennsylvania

BURROUGHS CORPORATION 6,7,8
6071 Second Avenue
Detroit 32, Michigan

BUSINESS AUTOMATION F-1
288 Park Avenue West
Elmhurst, Illinois

CALIFORNIA COMPUTER PRODUCTS, INC. 18
8714 Cleta Street
Downey, California

C-E-I-R, INC. 21,22
1200 Jefferson Davis Highway
Arlington 2, Virginia

C. P. CLARE & COMPANY 107
3101 W. Pratt Boulevard
Chicago 45, Illinois

CLARY CORPORATION C-5
408 Junipero Street
San Gabriel, California

COLLINS RADIO COMPANY B-23,B-24,B-25
P.O. Box 1891
Dallas 21, Texas

COMCOR, INC. B-19
5310 E. Pacific Place
Denver 22, Colorado

COMPUTER CONTROL COMPANY, INC. 37,38
983 Concord Street
Framingham, Massachusetts

COMPUTER SYSTEMS, INC. 9,10
Culver Road
Monmouth Junction, New Jersey

COMPUTRON, INC. B-15
122 Calvary Street
Waltham, Massachusetts

CONSOLIDATED ELECTRODYNAMICS CORPORATION 24,25
360 N. Sierra Madre Villa
Pasadena, California

CONTROL DATA CORPORATION 84,85,86
501 Park Avenue
Minneapolis 15, Minnesota

DASHEW BUSINESS MACHINES, INC. F-9
3655 Lenawee Avenue
Los Angeles 16, California

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Write today—to the address below—for advance information on all employers. Return the registration form by December 8 and your qualifications will be the first transmitted to Center employers when interviews begin Tuesday morning. If you can't be in Washington, interested employers will contact you by wire.

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CIRCLE 81 ON READER CARD

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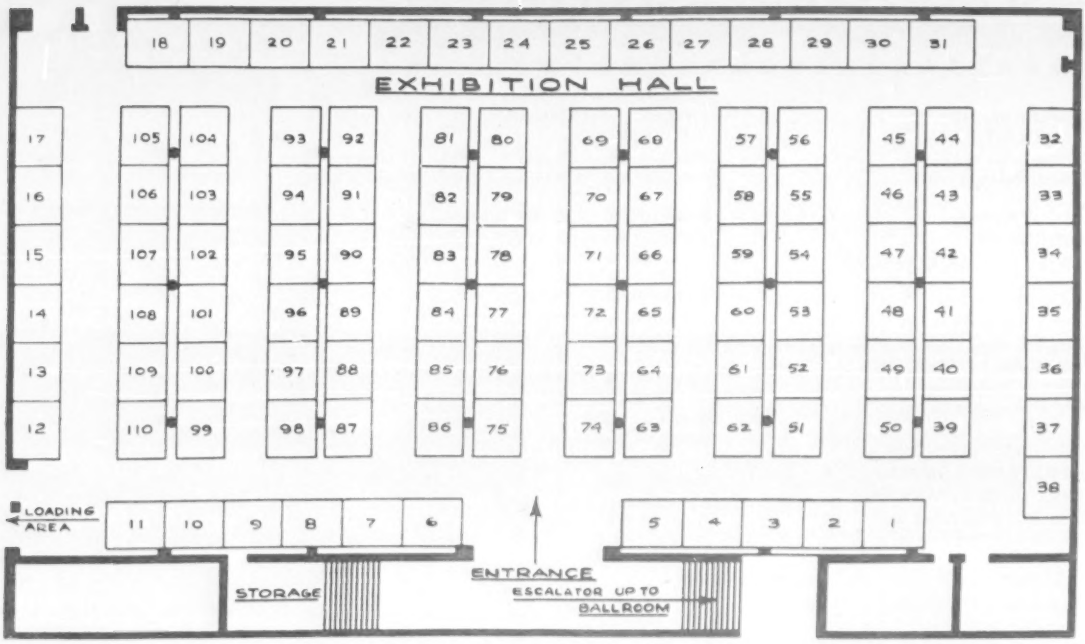

DATA DISPLAY, INC. 103,104
1820 Como Avenue
St. Paul 8, Minnesota

DATAMATION MAGAZINE 101
F. D. THOMPSON PUBLICATIONS, INC.
141 E. 44th Street
New York 17, New York

DATAPULSE, INC. B-17
509 Hindry Avenue
Inglewood 1, California

DI/AN CONTROLS, INC. 28
40 Leon Street
Boston, Massachusetts

DIGITAL EQUIPMENT CORPORATION 67,68,69,70
146 Main Street
Maynard, Massachusetts

DIGITRONICS CORPORATION 93,94,95
1 Albertson Avenue
Albertson, Long Island, New York

ELCO CORPORATION 36
M Street below Erie Avenue
Philadelphia 24, Pennsylvania

ELECTRONIC ASSOCIATES, INC. 81,82,83
Long Branch Avenue
Long Branch, New Jersey

ELECTRONIC MEMORIES, INC. ... B-9B
9430 Bellanca Avenue
Los Angeles 45, California

ENGINEERED ELECTRONICS COMPANY F-5,F-6
1441 E. Chestnut Avenue
Santa Ana, California

FABRI-TEK, INC. B-11
Amery, Wisconsin

FAIRCHILD SEMICONDUCTOR CORPORATION F-7,F-8
545 Whisman Road
Mountain View, California

FERRANTI ELECTRIC, INC. .... 26 & 27
Industrial Park #1
Plainview, Long Island, New York

GPS INSTRUMENT COMPANY, INC. 108
180 Needham Street
Newton 64, Massachusetts

GENERAL DYNAMICS/ ELECTRONICS 32,33,34,35
INFORMATION TECHNOLOGY DIVISION
1895 Hancock Street
San Diego 12, California

GENERAL ELECTRIC COMPANY F-3
DEFENSE SYSTEMS DEPARTMENT
4901 Fairmont Avenue
Washington 14, D.C.

GENERAL KINETICS, INC. B-4,B-5
2611 Shirlington Road
Arlington 6, Virginia

GERBER SCIENTIFIC INSTRUMENT CO. ..... 105 & 106
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Hartford, Connecticut

HARVEY-WELLS ELECTRONICS, INC. C-6
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Natick, Massachusetts

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13103 Ventura Boulevard
Studio City, California

INDIANA GENERAL CORP. 63,64
405 Elm Street
Valparaiso, Indiana

INDUSTRY REPORTS, INC. C-12
1327 F Street, NW
Washington 4, D.C.

INTERNATIONAL BUSINESS MACHINES 75,76,77,78,79,80
590 Madison Avenue
New York 22, New York

INVAC CORPORATION C-6
14 Huron Drive
Natick, Massachusetts

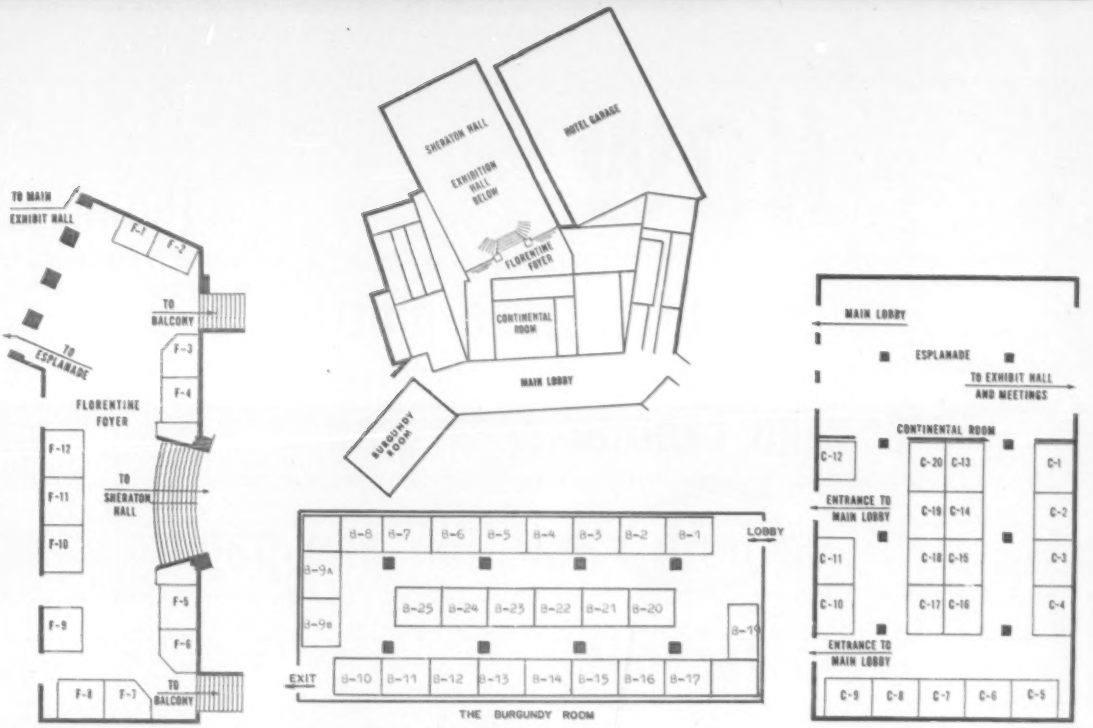
LABORATORY FOR ELECTRONICS, INC. 109,110
COMPUTER PRODUCTS DIVISION
1079 Commonwealth Avenue
Boston 15, Massachusetts

LITTON SYSTEMS B-3
336 N. Foothill Blvd.
Beverly Hills, California

MICRO SWITCH DIVISION 96
MINNEAPOLIS-HONEYWELL
Freeport, Illinois

MINNEAPOLIS-HONEYWELL EDP DIVISION 29,30,31
60 Walnut Street
Wellesley Hills, Mass.

MIDWESTERN INSTRUMENTS B-6
41st and Sheridan Rd.
Tulsa 18, Oklahoma



MNEMOTRON CORPORATION . . . B-9A
45 S. Main Street
Pearl River, New York

MONROE CALCULATING MACHINE COMPANY, INC. C-10,C-11
555 Mitchell Street
Orange, New Jersey

THE NATIONAL CASH REGISTER COMPANY 65,66
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OMNITRONICS, INC. B-16
511 N. Broad Street
Philadelphia 23, Pennsylvania

PACKARD BELL COMPUTER CORPORATION 1,2
1905 Armacost Avenue
Los Angeles 25, California

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RADIO CORPORATION OF AMERICA C-6,C-7,C-8,C-9
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8433 Fallbrook Avenue
Canoga Park, California

REEVES SOUNDCRAFT CORPORATION 11
Great Pasture Road
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REMINGTON RAND UNIVAC 39,40,41,48,49, 50,51,52,53
315 Park Avenue South
New York 10, New York

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A & Courtland Street
Philadelphia 20, Pennsylvania

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ROYAL McBEE CORPORATION . . 12,13
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New York 22, New York

SOROBAN ENGINEERING, INC. C-15,C-16
Box 1717
Melbourne, Florida

SPRAGUE ELECTRIC COMPANY . . 16,17
Marshall Street
North Adams, Massachusetts

SYLVANIA ELECTRONIC SYSTEMS 71,72,73,74
63 Second Avenue
Waltham 54, Massachusetts

TALLY REGISTER CORPORATION C-1,C-2
1310 Mercer Street
Seattle 9, Washington

TECH SERV, INC. F-4
4911 College Avenue
College Park, Maryland

TELETYPE CORPORATION . . C-13,C-14
5555 Touhy Avenue
Skokie, Illinois

TELEX, INC. B-20,B-21,B-22
DATA SYSTEMS DIVISION
1633 Eustis Avenue
St. Paul, Minnesota

TEXAS INSTRUMENTS, INC. . B-13,B-14
P.O. Box 5012
Dallas 22, Texas

UNDERWOOD CORPORATION 87,88,97,98
One Park Avenue
New York 16, New York

UPTIME CORPORATION C-17
175 Commerce Street
Broomfield, Colorado

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Baltimore 29, Maryland

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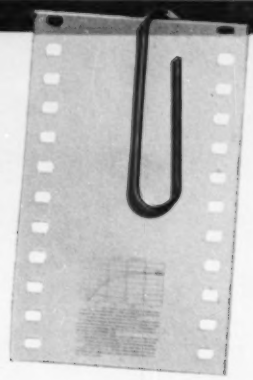
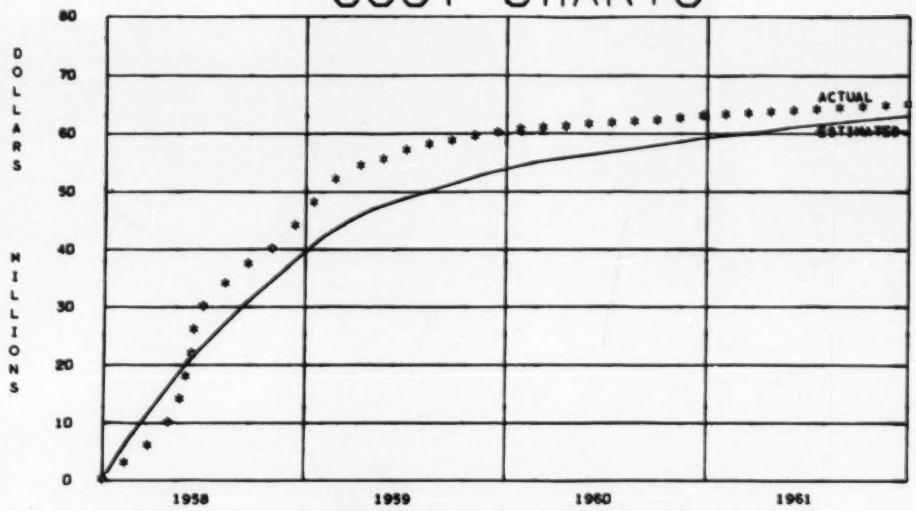


COST CHARTS



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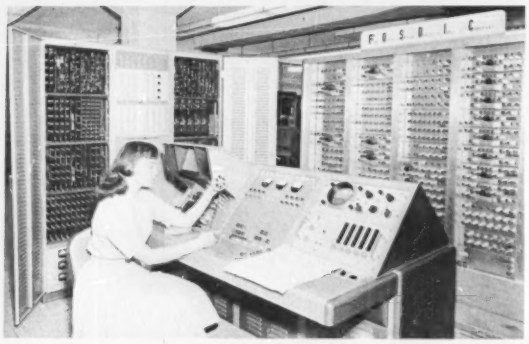
CIRCLE 25 ON READER CARD

S-C 4020 Samples

EJCC FIELD TRIPS PLANNED



At the Bureau of the Census, EJCC visitors will view FOSDIC (Film Optical Sensing Device for Input to Computers).

In Alexandria, Va., the main plant of Farrington Electronics will demonstrate the latest commercial version of their optical character reader.

The very large-scale Univac LARC to be seen at the David Taylor Model Basin is located about 12 miles from Washington.

In order that EJCC delegates may view some of the latest in computer systems and hardware in conjunction with their three-day conference in the nation's capital, four separate field trips are being arranged to take them to government installations and private manufacturing firms, Tuesday evening, December 12, to climax the first day of the conference.

Manufacturers of equipment to be shown at the conference will provide bus transportation to selected tour sites, and will return the delegates to the Sheraton Park.

One bus will take delegates to the U.S. Navy's David Taylor Model Basin, an experimental ship testing site at Carderock, Md., where they will be shown the LARC general purpose computer – one of the largest of its type in use. This same tour will also include the Army Map Service for a look at the Honeywell 800 and the ECCO-1000 language translator.

A second tour will visit NASA's Goddard Space Flight Center at Greenbelt, Md., while a third will go to the Bureau of the Census for a look at the FOSDIC data processing system.

Farrington Electronics, Inc., of Alexandria, Va., will be the destination of the fourth field trip, where delegates will see the latest in optical scanners. ■

★★★★★★★★★★★★★★★★★★★★

The Honeywell 800 with high speed tape units which may operate at 96,000 decimal digits per second is located at the Army Map Service.

secretary's desk?

No... a complete data processing system from Monroe for only $700 a month!

A fully transistorized, desk size, electronic computor, the new Monrobot XI is the least expensive complete data processing system yet devised. This is not a component. It is the entire system.

Data processing that every businessman can afford arrived with the advent of the Monrobot XI. For the large corporation, it allows decentralization . . . saves time . . . can be tied into large-scale systems. For medium and small sized businesses, its low price makes feasible—for the first time—the cost saving economies of automatic data processing. It is a particularly valuable piece of equipment for a service bureau.

No larger than a desk—requiring no special flooring or air conditioning—the Monrobot XI is unparalleled for efficiency and economy in doing general ledgers, profit and loss statements, subsidiary ledgers, cost accounting, and payroll.

For example, on a typical weekly payroll, it writes checks for eight-hundred employees in an eight-hour day, performing all operations automatically. With the addition of input-output devices that cost less than $200 a month, it prepares the payroll journal and employees earnings record—distributes costs to labor classifications—accumulates columnar totals by departments—sums columnar totals for the entire payroll run—and updates individual earnings records . . . *all in a one pass operation.* Yet it is no larger than a secretary's desk and can be used by any competent typist.

It substantially reduces processing time on almost any general business function . . . sales analysis, billing, inventory control, job costing, product scheduling, accounts payable—*you name it.* What's more it handles special jobs—everything from route accounting for bakeries, dairies, and the like, to stock and bond confirmations for brokerage houses—with unparalleled accuracy and economy. *It is the least expensive complete data processing system ever devised.*

At this low price—$700 a month to rent, $24,500 to buy—the Monrobot XI almost demands investigation. For information, write to: Electronic Computer Division, Monroe Calculating Machine Company, Orange, New Jersey.

MONROE

GENERAL OFFICES: ORANGE, NEW JERSEY • A DIVISION OF LITTON INDUSTRIES

CIRCLE 26 ON READER CARD

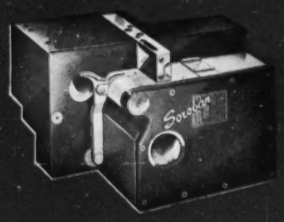
rapid

Most spectacular punched tape recording device to be released in recent years. The GP-2 is capable of operating at speeds up to 300 codes per second—3000 words per minute—or almost 10,000,000 holes per hour.

GP-2 SUPER-SPEED TAPE PERFORATOR

rugged

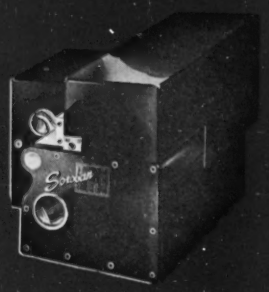
Designed for rugged operation at punching speeds up to 150 codes/sec. It has many of the design features of the GP-2 Super-Speed Tape Perforator including feed mechanism, magnets, punch and die assemblies.



LP-2 LOW SPEED PERFORATOR

reliable

Consists of LP-2 Low Speed Perforator and MT-1 Printer. The straight line input of tape permits installation of the print head adjacent to the punch and die assembly. The print station is capable of printing 64 different symbols at a rate of 100 characters/sec., 1000 words per minute.



PT-1 PERFORATOR-PRINTER

The unquestioned leader in the science of advanced computing based on sound, sophisticated engineering and manufacturing concepts of high speed data processing and control equipment.

Soroban perforators are now being used all over the world—in communications applications as well as computer and data processing facilities.

Soroban products permit electronic instrumentation, communications and data processing systems to communicate more easily and efficiently with the physical environment in which they operate.

For more detailed information on these and other Soroban products, write for our 44-page catalogue.

Soroban ENGINEERING, INC.

P. O. BOX 1717, MELBOURNE, FLORIDA, TELEPHONE PA 3-7221

CIRCLE 27 ON READER CARD

UNPRECEDENTED RELIABILITY!

Here is the first plotter ever built to operate around the clock–non-stop!

Sure, Gerber's new plotter is as accurate as any you've ever seen. Plots to ±.002". Repeats to ±.001".

But even more important, the Model GP-30-D operates at pinpoint precision 24 hours a day, seven days a week. No inaccurate plots, no need for test decks every few hours. Absolutely no drift.

In short, the GP-30-D will plot your data as fast and as long as your computer turns it out!

And reliability is just one of the many new features built into this new plotter. Here are a few more:

Maximum slewing speed: 20" per second.

Plotting speeds:
- 50 points per minute with points spaced up to 4½" apart from IBM cards.
- 42 points per minute when plotting at random.
- 80 points per minute with paper tape input.

Digital Logic: No digital to analogue conversion used. The digital logic is all solid state, plug-in cards, which actually make up a special purpose computer.

No potentiometers: Magnetic-type discreet shaft encoders eliminate all drift and warm-up time.

Drive system: Precision ball screws driven by ¼ hp. motors.

Choice of tables: Plotter available with a vertical table as well as the horizontal table shown.

For plotting accuracy and reliability, there is no "or equal." Write for full details.

See this all-new plotter at Booth No. 105-106 of the Eastern Joint Computer Conference, Dec. 12-14, Sheraton Park Hotel Washington, D.C.

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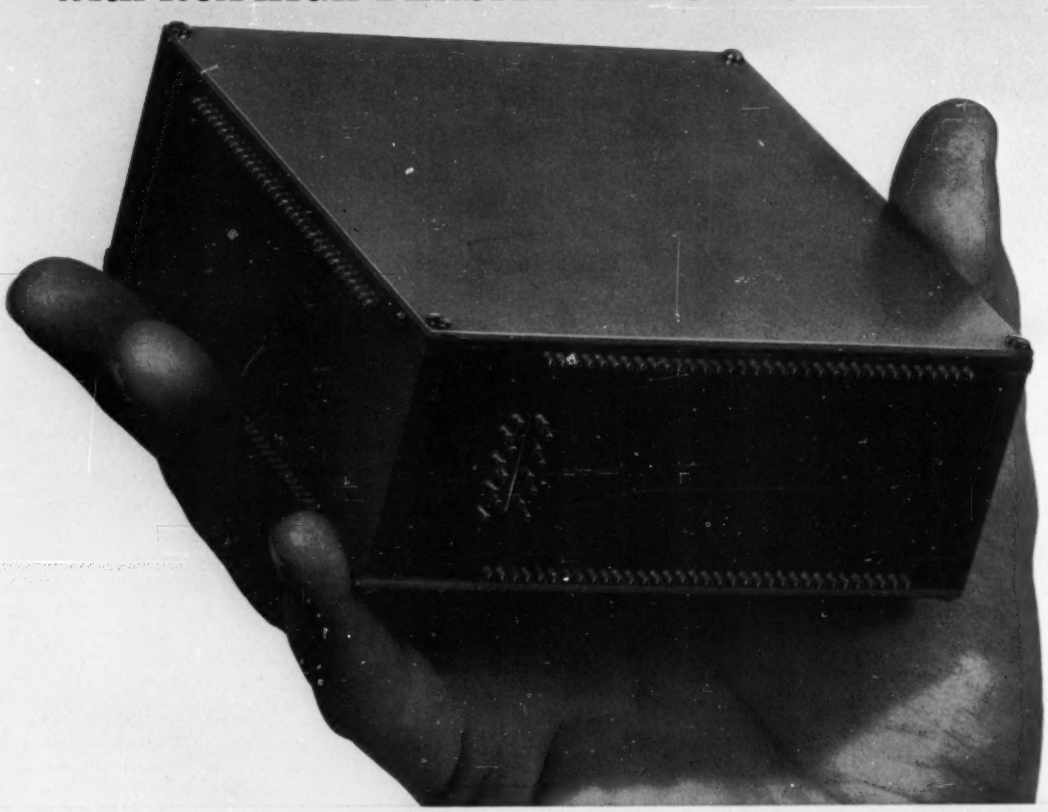
P. O. Box 305 • Hartford, Conn.

Branch sales and service offices at: Washington, D.C. RE 7-6992 • Los Angeles, Calif. MU 1-5745 • Toronto, Canada AX 3-7011

CIRCLE 28 ON READER CARD

Now Pack More Data Into Every Cubic Inch with RCA HIGH DENSITY MEMORY STACKS...



TEMPERATURE CONTROLLED WITHIN ±2°C...DESIGNED TO MEET MIL SPECIFICATIONS

Occupying only 4.75 x 4.75 x 2 inches of space, this 4,096-word (8 bits per word) temperature-controlled magnetic-memory stack is available for a broad range of military, industrial and commercial computer applications.

RCA introduces new high density temperature-controlled memory stacks to meet the environmental extremes under which many of today's computers must operate. These new stacks incorporating RCA ferrite memory cores with specified wide operating margins are designed to cope with broad variations in power levels. In addition, they are built and tested to meet and exceed the environmental requirements of stringent military specifications.

MILITARY RELIABILITY: New RCA miniaturized high density memory stacks undergo and pass the MIL requirements pertaining to: Temperature Cycling, Vibration, Shock, Humidity, High Temperature, Barometric Pressure, Fungus Resistance, Salt Resistance. In addition, all stacks are 100 percent dynamically tested to assure the highest possible degree of dependability under actual computer operating conditions.

WIDE VARIETY: New RCA miniaturized memory stacks can be ordered in sizes to suit your requirements. Even the smallest temperature-controlled versions will maintain a temperature of + 85°C ± 2°C over free air temperatures ranging from − 55°C to ± 85°C. RCA temperature-controlled stacks reach their 85°C operating temperature in only 15 minutes.

With these new miniaturized memory stacks RCA now offers one of the industry's most comprehensive lines of memory components. RCA magnetic memory specialists are ready to custom design virtually any stack you specify.

SERVICE: Your local RCA Semiconductor and Materials Division Field Representative is prepared to provide a completely coordinated applications service covering transistors, tunnel diodes and other semiconductor diodes, ferrite components and memory systems. Call him today. For further technical information, write RCA Semiconductor and Materials Division, Commercial Engineering, Section K-109-NN, Somerville, N.J.

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CIRCLE 29 ON READER CARD

NEWS BRIEFS

IR CONTRACT AWARDED FOR MEDICAL LITERATURE

General Electric has been awarded a major contract by the U.S. Public Health Service for the development of an IR system at the National Library of Medicine to be known as MEDLARS (Medical Literature Analysis and Retrieval System).

Library director Dr. Frank B. Rogers explained, "There have been other efforts in the bibliographic field with systems using electronic computers, but none approaching the size of this one." MEDLARS will be designed to process several hundred thousand pieces of bibliographic information annually. Development, installation and testing will require about two years.

NASA TO USE GENERAL MILLS COMPUTER

A General Mills AD/ECS, gp digital computer has been installed at NASA's Goddard Space Flight Center to be used in analysis of real time satellite control problems.

The AD/ECS has a 36 bit word length and 4K words of core memory. It also features two 64-word core buffer memories and a 1-word buffer register. The computing system may be altered in storage capacity, operational registers and even order structure. It plugs into standard 110-volt, 60-cycle house current, and may be used for scientific and engineering calculation and for direct data handling and processing.

CIRCLE 105 ON READER CARD

25TH H-800 SHIPPED TO PHILA. ELECTRIC

Honeywell's 25th 800 was shipped to the Philadelphia Electric Co. It will be utilized in the billing of the company's 1.1-million customers as well as for engineering, economic and general accounting problems.

The first 800 was delivered early in January to the Associated Hospital Services of New York. Walter W. Finke, president of Honeywell's EDP division, said that the sales value of the 25 800's presently shipped is about $36-million.

CIRCLE 106 ON READER CARD

JOINT USERS GROUP TO MEET IN WASHINGTON

The Joint Users Group will meet as an affiliate of the ACM on December 11th, at the Sheraton Park Hotel, Washington, D.C., where ratification of the conditions of membership by the participating member groups is expected, and action on common user group problems is to be taken.

At the September ACM national meeting in Los Angeles, Harry Cantrell, vice-chairman of the group, gave a comprehensive talk on this federation of user groups, and JUG also sponsored a discussion concerning the effects of monitor systems on programmer-machine communication and on operating procedures.

Thirteen founding user groups and the ACM met again in Los Angeles in May, to settle the question of affiliation with the ACM and to discuss communications, standards and computer installation problems.

SDC DEDICATES $3,000,000 LAB

System Development Corporation's recently completed $3,000,000 Systems Simulation Research Laboratory, located in Santa Monica, Calif., was dedicated on September 29. One of the first projects of SSRL will involve a model of a terminal air traffic control system and the laboratory will also be used in areas which include research in system training and theory, medical data processing and automated teaching. A Philco 2000 computer, purchased by SDC, is the principal hardware in the Laboratory.

For air traffic control, the system has been designed to simulate aircraft arriving and departing in a high-density terminal area in the post-1970 period.

CIRCLE 108 ON READER CARD

AUERBACH VIEWS EDP OVERSEAS

"The International Impact of Computers" was the subject of a talk given by Issac L. Auerbach, president of Auerbach Corporation, Philadelphia and New York, at a recent symposium, sponsored by the Washington, D. C. chapter of ACM. Auerbach stated that in the United States there are over ten times as many medium and large-scale dp equipment installations as there are in the rest of the world but that the world market for this equipment is growing rapidly.

Auerbach feels that in some of the newly-emerging countries, such as Africa and Southeast Asia, the need for electronic information processing

COMPUTER CONCEPTS SELLS FRUGAL & 7090 TIME

The fact that Computer Concepts is well into the computer business was made evident last month by two major announcements from the newly organized, Washington D. C. consultant firm.

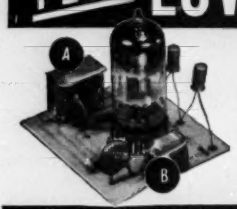
First, an off-the-shelf programming package called FRUGAL (FORTRAN Rules Used as a General Applications Language) was made available to 7090 users on a guaranteed delivery basis. The package is to be used in the solution of general business problems and is reportedly priced at a fraction of the cost of a comparable individual development.

FRUGAL incorporates variable length record description, manipulation and sorting automatic data manipulations and conversion; extended FORTRAN statements; a simple report writing facility; a simple file description including multi-description files, and MAJOR/MINOR, a new concept of variable data design and storage.

CC's second announcement indicated that the firm would be sole leasing agents for the sale of time on a 7090 located at Westinghouse's Services Building in Baltimore. This is the first occasion in which a private consultant firm has been contracted to sell time for a major U.S. corporation such as Westinghouse.

CIRCLE 107 ON READER CARD

MINIATURIZATION PLUS LOWER COST



Thin Versatile Co-Netic and Netic Magnetic Shielding Foils

Permit positioning foil-wrapped components A & B closely, minimizing interaction due to magnetic fields . . . making possible compact and less-costly systems.

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These foils are non-shock sensitive, non-retentive, require no periodic annealing. When grounded, they effectively shield electrostatic and magnetic fields over a wide range of intensities. Both foils available from stock in any desired length in various widths.

Co-Netic and Netic foils are successfully solving many types of electronic circuitry magnetic shielding problems for commercial, military and laboratory applications. These foils can be your short cut in solving magnetic problems.

Cuts readily to any shape with ordinary scissors.

Wraps easily.

Inserts readily to convert existing non-shielding enclosures.

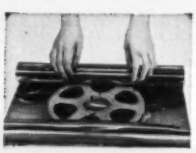
Shielding cables reduces magnetic radiation or pickup.

Wrapping tubes prevents outside magnetic interference.

PROTECT VITAL MAGNETIC TAPES

When accidentally exposed to unpredictable magnetic fields, presto!—your valuable data is combined with confusing signals or even erased.

For complete, distortion-free protection of valuable magnetic tapes during transportation or storage. Single or multiple reel Rigid Netic Enclosures available in many convenient sizes and shapes.


Thin pliable foil wraps easily around magnetic tape, maintaining original recorded fidelity.

Rigid Netic (.014" and up in thickness) Shielded Rooms and Enclosures for safe, distortion-free storage of large quantities of recorded magnetic tapes.

Composite photo to demonstrating that magnetic shielding qualities of Rigid Netic Alloy Material are not significantly affected by vibration, shock (including dropping or bumping) etc. Netic is non-retentive, requires no periodic annealing.

Write for further details today.

MAGNETIC SHIELD DIVISION PERFECTION MICA CO.
1322 No. Elston Avenue, Chicago 22, Illinois
ORIGINATORS OF PERMANENTLY EFFECTIVE NETIC CO-NETIC MAGNETIC SHIELDING

CIRCLE 30 ON READER CARD

NEWS BRIEFS . . .

equipment is as pressing as in some of the more highly developed countries. Rather than training native workers to learn bureaucratic and managerial skills, it was his suggestion that it might be more prudent to fill the need by use of data processing.

COMPUTER EXHIBIT IN GREAT BRITAIN

A recent exhibition of computers in England attracted heavy attendance but produced only minor news events. English Electric introduced the small-scale KDN2, a solid state machine selling for about 80K and the same company was reputed to have signed $2,800,000 worth of orders with the British government at the show. IBM World Trade withdrew its 3000 series from the European market replacing it with the 21 series, and RCA and ICT have concluded a trade agreement "to exchange technical information" which may broaden into ICT's sale of the 301 in England in competition with De La Rue Bull in England and Bull on the continent. The 301 would be designated as the ICT 1501.

CHARACTER RECOGNITION SYMPOSIUM SCHEDULED

A Symposium on Optical Character Recognition will be held on Jan. 15-17 in the Dept. of Interior Auditorium, Wash., D.C. It will be jointly sponsored by the Information Systems Branch of the Office of Naval Research and the Research Information Center of the National Bureau of Standards.

The objective of the Symposium will be to bring together equipment specialists, scientists and potential users interested in exploiting automatic character recognition techniques. Where feasible, demonstrations of equipment operating in the Washington area will be arranged. For more information contact Josephine Leno, Code 430A, Office of Naval Research, Washington 25, D.C.

IBM SIMULATES INFO HANDLING SYSTEMS

IBM's Advanced Systems Development Division is presently involved in the construction of a new general purpose simulation program (GPS) which will simplify the development of information handling systems before they are actually constructed. IBM systems engineers are currently using the program on an

For a Complete Line of
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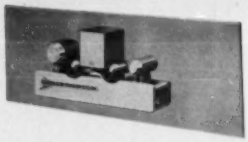
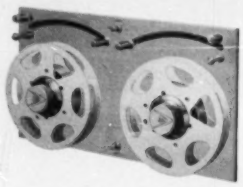
DIGITRONICS

High Speed, All Solid State HANDLERS and PHOTO-ELECTRIC READERS

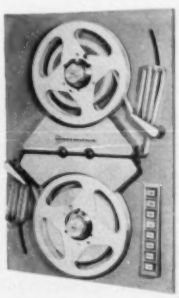


MODEL 3500 Uni-Directional Reader. Speeds to 2000 cps. Stops before the following character at 1000 cps.

MODEL B3500 Bi-Directional Reader. Speeds to 1000 cps. Stops before the following character at 1000 cps.



MODEL 4566 Bi-Directional Tape Handler. For use with model 3500 or B3500 readers. Handles 500 feet of 5 to 8 level tape, in either direction, at speeds to 400 cps. Rapid rewind at 1000 cps.



MODEL 4500 Integrated High Speed Bi-Directional Reader. Full servo reel control. Speeds to 600 cps. while handling 1000 feet of 5 to 8 level tape. Integrated electronics chassis contains vacuum tube reel servos, solid state controls and channel amplifiers.

No matter what your requirements . . . whether for use with digital computers, machine tool controls, ground support or other instrumentation . . . 8 basic Dykor® models each of modular design allow Digitronics to tailor its equipment to meet your specific requirements. All solid state construction for years of low maintenance operation. Speeds from 50 to 2,000 characters per second, 5 to 8 level interchangability, dual speed motors and many other Digitronics options.

See your local Digitronics representative listed below or write for full technical information to:

If you plan to attend the **EJCC** in Washington, D. C., December 12-13-14, be sure to visit

BOOTHS 93 - 94 - 95

to see the **NEW** readers and handlers, as well as the demonstration of the Dial-o-verter System transmitting data between Washington and New York.

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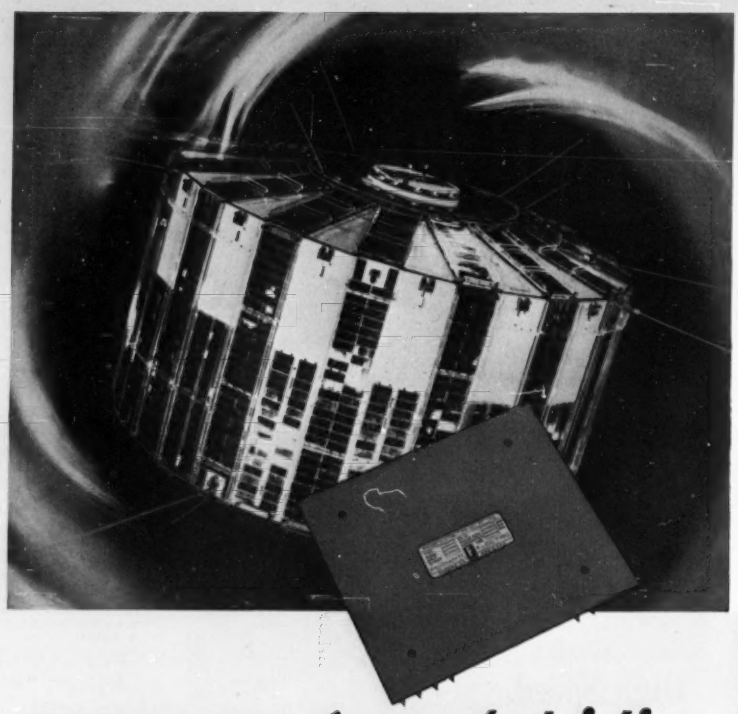
CIRCLE 31 ON READER CARD



FERRANTI *Magnetostriction*
DELAY LINES
Are Vital Components of
TRANSIT IV-A

When the U.S. Navy orbited Transit IV-A navigation satellite, Ferranti Delay Lines withstood the severe vibration, acceleration, and high temperature that accompanied the launch and are now working perfectly under conditions of prolonged high vacuum! Ferranti Delay Lines are a vital part of the satellite's memory storage system.

These Lines are a straightforward modification of Ferranti's standard Type L35 package used successfully on a wide commercial scale. *No major changes in construction or technique were required.* Ferranti Lines were approved by the U.S. Navy after an exhaustive testing program to confirm their capability to survive the most rigorous launching conditions.

Ferranti Lines are supplied to meet a wide variety of applications and can always be relied upon for dependable performance.

THE MAGNETOSTRICTION DELAY LINES USED IN TRANSIT IV-A FEATURE VERY LOW POWER CONSUMPTION AND EACH IS CAPABLE OF STORING 2000 BITS AT A 1MC/S DIGIT RATE. PACKAGE DIMENSIONS ARE 9-7/8 X 8-5/8 X 13/32 INCHES. EXTERNAL TEMPERATURE CONTROLS ARE UNNECESSARY.

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CIRCLE 32 ON READER CARD

NEWS BRIEFS . . .

experimental basis for such systems as SABRE to evaluate a variety of system designs.

The GPS program is based on the language of block diagrams so that simulation can begin directly from an engineer's block diagram description of a system which is transferred to cards and loaded into a computer to determine system capacity, delays, and the effects of varying loads and operating speeds. Output may be obtained as individual transactions are completed or about all transactions in the system at a particular point during the simulation.

CIRCLE 109 ON READER CARD

● D. D. McCracken Associates will offer a one week course in creative technical writing with primary emphasis on the computing field from Dec. 4-8 at the Hotel Lexington, N.Y.C. Although enrollment is limited to 20 persons, the course will be repeated at a later date. For course fees and information, write to McCracken Assoc., 7 Justamere Drive, Ossining, N.Y.

CIRCLE 110 ON READER CARD

● RCA has changed the name of its West Coast Missile and Surface Radar Div. to the Data Systems Div., which will continue as part of the six-division RCA Defense Electronic Products activity. Work in the field of military data handling will be concentrated at the Van Nuys, Calif., facility as well as construction of the 604.

● UCLA has recently installed a 7090, the first such system on a university campus. The $3,000,000 system is being financed from non-tax funds with substantial support from IBM and a $375,000 grant from the National Science Foundation. The computer will be shared by the newly created UCLA Computing Facility and the Western Data Processing Center.

● An IBM 7080 has been installed in the McDonnell Automation Center where it will replace the 705 II. The 7080 will be used mainly for engineering and scientific applications including structural, thermodynamic and aerodynamic analyses for current aerospace projects.

● A Honeywell 400 will be installed early next year in Ann Arbor, Mich., for analyzing the records of some 2.5

MAC PANEL *computer tape* . . . ASSURED PERFORMANCE

EVERY REEL... TESTED FOR PERFORMANCE

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MAC Panel Computer Tape is thoroughly tested to give you greater assurance against tape-caused system malfunction.

Quality control of MAC Panel Computer Tape does not end with the production operation . . . it continues through a rigorous testing phase and even into packaging and shipment to computer installations. In fact, the pre-production and final testing facilities

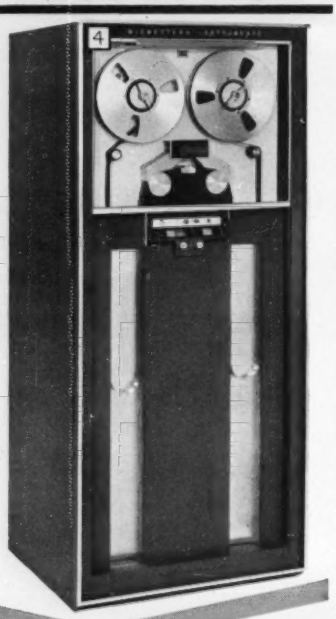
far exceed the normal criterion for attention to detail. This means you can rely on MAC Panel Computer Tape . . . *Manufactured for Performance . . . Tested for Performance . . . Packaged for Performance.*

Ask your MAC Panel representative for the full story . . . and you'll also want to write for the informative booklet, "MAC Panel Computer Tape . . . Assured Performance."

CIRCLE 33 ON READER CARD

MAC PANEL COMPANY □ **High Point, North Carolina** MAC PANEL

NOW IN PRODUCTION



M3000

MIDWESTERN REPLACES THE WEAKEST LINK IN AUTOMATIC DATA PROCESSING SYSTEMS with the M-3000 DIGITAL TAPE TRANSPORT SYSTEM

WRITE OR CALL FOR LATEST SPECIFICATIONS: M-3000

MIDWESTERN INSTRUMENTS
manufacturers of Ampex "professional" tape recorders
P. O. Box 7509 / PHONE NAtional 7-1111
TULSA 18, OKLAHOMA

CIRCLE 34 ON READER CARD

NEWS BRIEFS . . .

million patients who will be discharged from U.S. hospitals in 1962. The results of the study will enable hospitals to compare their patient-to-patient performance with scores of other institutions. The work will be performed by the Commission on Professional and Hospital Activity.

CIRCLE 111 ON READER CARD

● A joint preliminary agreement for the marketing of the Clary DE-60 has been entered into by Smith-Corona Marchant and Clary Corp. SMC's automatic electric typewriter, one component of the DE-60, was used in their Typetronic dp equipment. Clary management has stated that their interests are solely in the small computer market and has reported the installation of 34 desk-size machines.

CIRCLE 112 ON READER CARD

● Four components of the Philco 2000, the 256-1 printer system, 259 punched card controller and the 252 and 280 universal buffer controllers, have had a rental decrease of 35 per cent.

CIRCLE 113 ON READER CARD

● Digitronics Dial-o-verter system has transmitted, without error, over 1,000,000 words of business data for Mohasco Industries, Inc., and has also reduced daily transmission time for the firm's interplant communication between Amsterdam, N.Y. and Greenville, Miss. from nine hours to 70 minutes.

CIRCLE 114 ON READER CARD

● Two hundred IBM Tele-processing terminals, capable of handling up to 60,000,000 words daily, will be delivered to Western Union for installation in the U.S. Air Force Combat Logistics Network (COMLOG-NET), the world's largest data and message network, scheduled for completion in 1962.

● The Dayton Power and Light Co. plans to establish an EDP center which will be the first in the utility industry to use magnetic imprinting on customer bills. The system to be installed will be built around two NCR 315's.

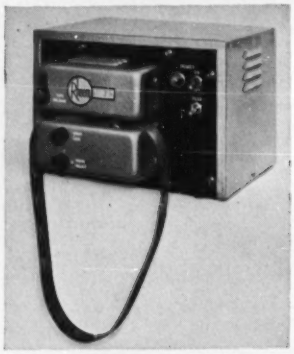
CIRCLE 115 ON READER CARD

● Autonetics' first RECOMP III has been installed at Trunkline Gas Co. in Houston, Texas, where it will be used primarily for operations analysis.

CIRCLE 116 ON READER CARD

Rheem
Offers You . . .
RELIABILITY ACCURACY

Rheem Electronics Designs and Builds a Full Line of Automation Specialty Accessories, Including . . .



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For: Radar Antenna Angular Position Sensing ■ Machine Slide Position Sensing for Position Display Purposes ■ Scale Platform Sensing for Digital Weight Readout ■ Analog to Digital Converters

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A Division of Rheem Manufacturing Company
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CIRCLE 35 ON READER CARD

SUBTRACT QUANTITY-SOLD FROM BALANCE-ON-HAND. IF BALANCE-ON-HAND IS NOT LESS THAN REORDER-LEVEL THEN GO TO BALANCE-OK ELSE COMPUTE QUANTITY-TO-BUY = TOTAL-SALES-3-MOS/3.

THE LANGUAGE ABOVE IS COBOL ... COMMON BUSINESS ORIENTED LANGUAGE. IT LETS YOU GIVE YOUR IBM COMPUTER INSTRUCTIONS WITH WORDS THAT CLOSELY MATCH EVERYDAY BUSINESS LANGUAGE. THE BENEFIT -- HOURS, DAYS, WEEKS OF TIME SAVED BY ELIMINATING DETAILED MACHINE LANGUAGE INSTRUCTIONS LIKE THESE:

06000	?	12048	12047	06096	'	12042	
06011	'	12040		06102	?	12017	12046
06017	?	12007	12043	06113	@	12013	12047
06028	@	12002	12047	06124	H	12042	
06039	C	12047	12049	06130	?	12047	12022
06050	J	06068	U	06141	'	12043	
06057	A	12050	12046	06147	?	12012	12047
06068	H	12040		06158	S	12022	12047
06074	?	12046	12012	06169	H	12043	
06085	?	12048	12047	06175	?	12047	12027

YOU DESCRIBE YOUR PROBLEM USING THE COBOL LANGUAGE. YOUR COMPUTER THEN TRANSLATES THESE STATEMENTS USING A PROGRAM CALLED A PROCESSOR. THE COBOL PROCESSOR TAKES THE ENGLISH LANGUAGE COMMAND, PREPARES COMPLETE MACHINE LANGUAGE INSTRUCTIONS, AND GIVES YOU A READY-TO-RUN PROGRAM. NOW, YOUR PROGRAMMERS ARE FREE TO CONCENTRATE MORE PROFITABLY ON SOLUTIONS TO PROGRAMMING PROBLEMS THAT ARE UNIQUE TO YOUR COMPANY.

IBM'S LONG EXPERIENCE IN BRINGING YOU SUCH PROGRAMMING LANGUAGES AS AUTOCODER, FORTRAN, COMMERCIAL TRANSLATOR, AND IOCS IS NOW BEING APPLIED TO THE PREPARATION OF COBOL PROCESSORS FOR THE IBM 1401, 1410, 705, 705III, 709, 7090, 7070, 7072, 7074 AND 7080 DATA PROCESSING SYSTEMS.

IBM'S COBOL LANGUAGE MEETS THE LATEST SPECIFICATIONS SET BY THE FEDERAL GOVERNMENT.

TO SEE HOW COBOL AND OTHER PROGRAMMING SERVICES CAN HELP YOU SAVE TIME AND MONEY, CALL YOUR LOCAL IBM OFFICE.

IBM
DATA PROCESSING

A MOLECULAR COMPUTER

from Texas Instruments

A general purpose, molecular computer was demonstrated last month by Texas Instruments, Inc., Dallas, Texas, as one experimental result of its molecular electronic program under the technical guidance of the Electrical Technology Laboratory of the U.S. Air Force's Aeronautical Systems Division.

Utilizing semiconductor networks, the microminiature digital computer has a total volume of 6.3 cubic inches and weighs 10 ounces. It is reported as providing the identical electrical functions of a special purpose computer using conventional components which is 150 times its size and 48 times its weight and which was also demonstrated for purposes of comparison.

The T.I. computer was constructed from 587 digital circuits each formed within a minute bar of silicon material.

The computer is a serial, binary, fixed-point machine with an operand word length of 10 bits, plus sign. It uses synchronous logic, being timed from an internal 100-kilocycle clock. Memory is divided into two parts: the operand and instruction memory.

While the computer is general purpose, it was programmed in the recent demonstration to simulate a desk calculator, and performed addition, subtraction, multiplication, division and square root calculations.

A manual control unit was designed and developed by T.I. to provide a means for monitoring and control of the computer and to allow manual programming. A bilateral converter is also included in the manual control so that decimal input and output data may be utilized with the binary computer. Power supplies for both the manual unit and the computer are contained in the manual control.

For purposes of demonstration, the electrical designs of both the conventional and molecular computer were the same, and the manual control provided a means for demonstrating both machines.

Three types of semiconductor networks were used in the microminiature computer: RS flip-flop, NOR gates, and logic drivers. Total power dissipation of the computer is 16 watts.

Individually hermetic-sealed semiconductor networks, 0.250" x 0.125" x 0.030", were assembled by welding 8 to 16 together in a stack and then encapsulating the stack to form a rigid module. The computer of 47 modules is plugged into a computer matrix, each module containing an average of 12 networks and occupying approximately 0.057 cubic inches and weighing 0.04 ounce. Assembly work is performed under a 10-power microscope without using special tools.

The computer's total of 587 digital circuits replaces 8,500 transistors, diodes, resistors and capacitors required to perform the identical electrical functions in conventional hardware.

The molecular computer was constructed by T.I. to demonstrate a capability for solving the problems of interconnections, thermal dissipation, electrical interaction, and maintenance of high density packaging.

The demonstration also emphasized the suitability of semiconductor networks for many of today's military digital equipment design programs. It is expected that there will be wide application in guidance, telemetry and other areas of information processing. The important features of this new product advance, aside from size and weight reduction, are the potential for improved reliability and reduced cost.

An earlier announcement (not a demonstration) in the area of molecularized, digital computing has emanated from Westinghouse's air arm division in Baltimore. A device called "Mol-E-Com" is reportedly one-tenth the size and weight of a transistorized machine with similar capabilities and utilizes a solid semiconductor crystal with three to six molecular blocks. Installation is scheduled for the end of '62.

No commercial applications are presently visualized for either machine. ■

NEXT MONTH IN DATAMATION

The secrets of Control Data Corp.'s success in the computer field will certainly not be unveiled in our December issue but a taped interview with CDC president Bill Norris will provide some unusual introspection into this fast growing, spunky competitor. A staff-written study of leasing plans and trends, a report on compiler integration, and a profile of the Univ. of Michigan's much-discussed MAD language, and an impressive contribution to the study of machine intelligence will also be featured next month.

DIGITAL CLOCKS

Up to 86,400 contact combinations per day in Decimal or Binary Coded Decimal form for Programming . . . Process Control . . . Test Data Logging . . . Computer Systems.

Time in increments of minutes, tenth minutes, or seconds. Time of day (12 hour or 24 hour) — Count Down or Elapsed Time configurations.

Easy to read, single or multiple displays. Output compatible with printers, typewriters, card punches, etc. Special models. For details write:

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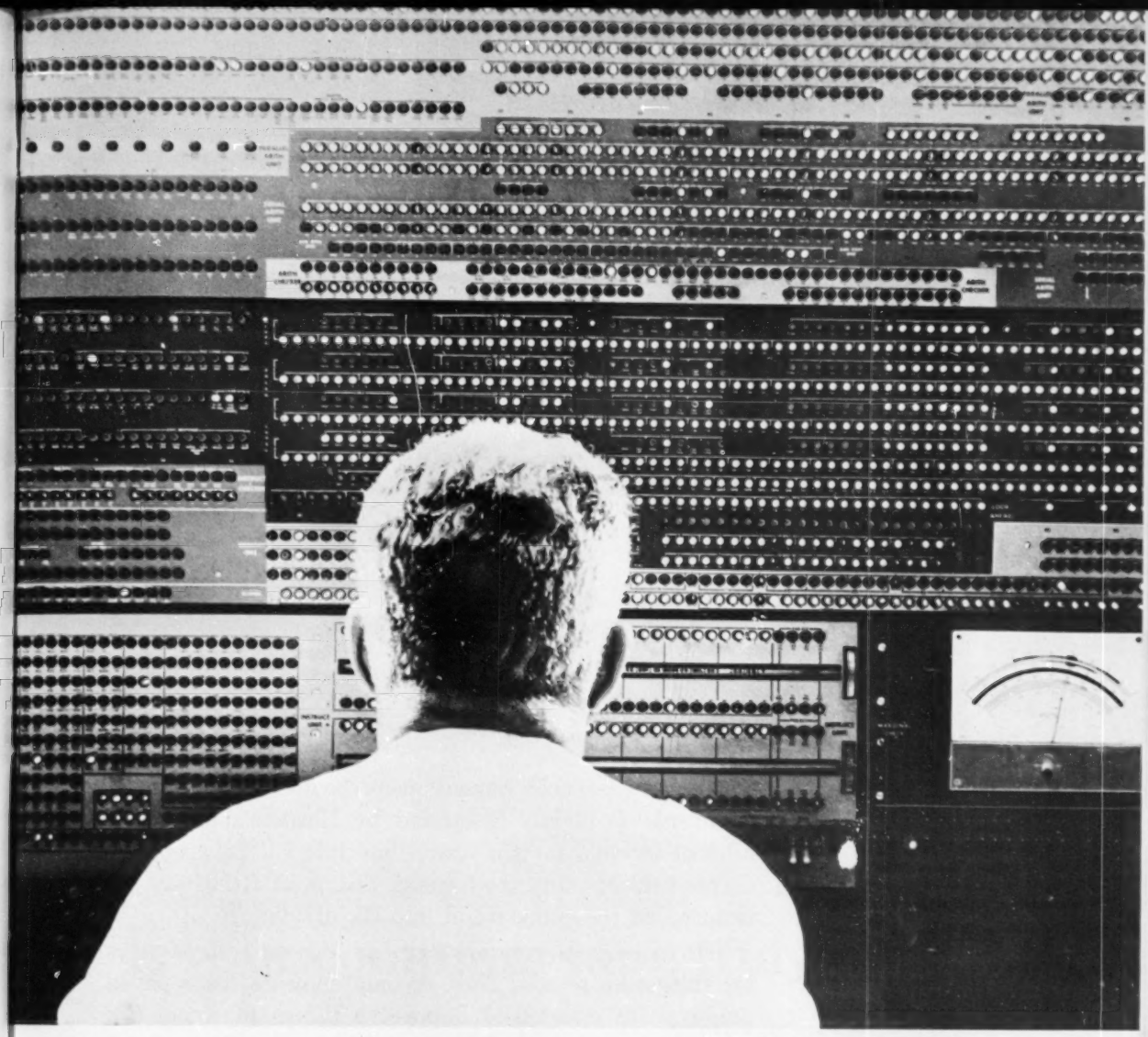
CIRCLE 37 ON READER CARD



on the destiny of nations

Remarks of Dr. Herbert W. Robinson, President, C-E-I-R, Inc., on the Occasion of the Groundbreaking for the New Cambridge Technology Square

In the middle ages, the destiny of nations was often decided by the clash of armies representing only a small fraction of the total population. Territories changed hands and people were enslaved through the plitting together of perhaps less than twenty thousand men on each side.

By 1914, war had become almost total war and we saw for years millions of men locked in mortal combat in the trenches of France. In World War II, war was indeed total, involving civilian populations as combatants and victims. However, a new factor had by then emerged—science.

Mr. Winston Churchill pointed out in his tribute to the Royal Air Force in 1940 that—**"Never in the field of human conflict was so much owed by so many to so few"**—since the fate of Britain turned on perhaps a few thousand fighter pilots. Even more dramatically to the point, it might be said that the fate of Britain depended on one man—R. J. Mitchell, who designed the "Spitfire" fighter plane.

The rapid advance of technology in the generation since the Battle of Britain means that today the outcome of any new war, with its emphasis on missiles and space, depends on the superiority of our technical "state of the art" compared with that of the Soviet bloc.

Once again the destiny of nations depends on perhaps twenty thousand individuals—a new kind of "few," the best of the technologists—on each side of the Iron Curtain.

It is fitting, therefore, that we participate in the groundbreaking for a new center of advanced technology second to none in the world. We are proud to be the first to tenant the first building. More importantly, we are proud that our company—which is, in brief, **intellect plus the amplifiers of intellect,** the electronic computers—will **serve** this center and this nation.

With this in mind, we shall install at Technology Square the largest assembly of computing equipment in the world, including the fabulous IBM STRETCH, bringing to our technologists capabilities in computing and analysis far ahead of any now available in existing equipment.

We wish Technology Square well and hope we may play with distinction our role in support of an important new member of the free world's technological battalions.

C-E-I-R INC.

World's Largest Corporation for Economic, Industrial & Operations Research. Corporate Headquarters: 1200 Jefferson Davis Highway, Arlington 2, Virginia

CIRCLE 38 ON READER CARD

C-E-I-R Centers with a full range of professional skills and advanced computer services are located in Washington, New York, Boston, Los Angeles, San Francisco, Houston, Hartford, London and Paris

$$\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2 - 186{,}000\,(t_1 - t_2)^2}$$

absolute

The way a basic achievement opens the door to still greater discoveries is vividly illustrated by Einstein's work. His original formula for the space-time interval between two events led him on to the General Theory of Relativity. It, in turn, led the entire world into the atomic age.

Excitement is running high at UNIVAC® these days for this same reason. New accomplishments have paved the way for even more impressive things to come. For example, UNIVAC was first to break through into *real time* computing. Another milestone is *Thin Film* which serves as a new, faster, yet physically smaller memory for computers. Extensive research in micro-miniaturization of logic modules is being done to make tomorrow's computers more compact, with even greater capability, versatility, and reliability.

The doors opened wide by these developments lead to worlds as yet little known. UNIVAC is committed to explore and chart them.

First with real time computing speeds... **UNIVAC**

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Is your computer tape truly clean?

(If so, you must be using Ampex)

Ampex is the first truly *clean* computer tape! It's produced in a controlled atmosphere, under the most rigid precautions. Every roll must pass intensive electrical and physical tests before packing.

Then, when Ampex engineers are almost sure it's perfect, they take another step to insure it's truly *clean*. They "bathe" it in a special chemical bath that removes all extraneous matter that might cause even a "temporary dropout."

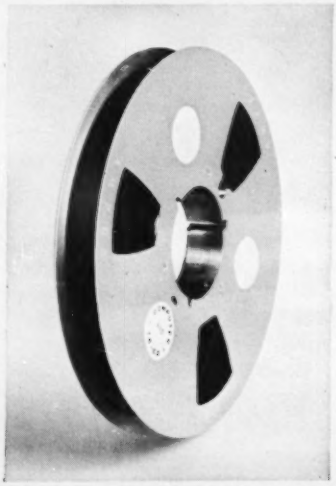
But that's not all. Every inch of Ampex Computer Tape is digitally checked to make sure every reel is completely error-free before it leaves the plant. What's more, it's tested on systems compatible with those it will be used on.

Another thing about truly clean Ampex tape is that it keeps your system cleaner, too! The exclusive Ferro-Sheen process insures a smooth, clean surface that reduces headwear and oxide build-up . . . so you have less costly downtime for cleaning! Ampex performs better and runs cleaner than any other tape!

Some people say we take excessive precautions in making sure our tapes are truly clean and error-free. But this is the kind of deliberate excess that makes products superior enough to be called Ampex, a name that's known for perfection!

To test Ampex superiority, compare our computer tape, at 556 BPI, against any other tape made. See for yourself what Ampex can do!

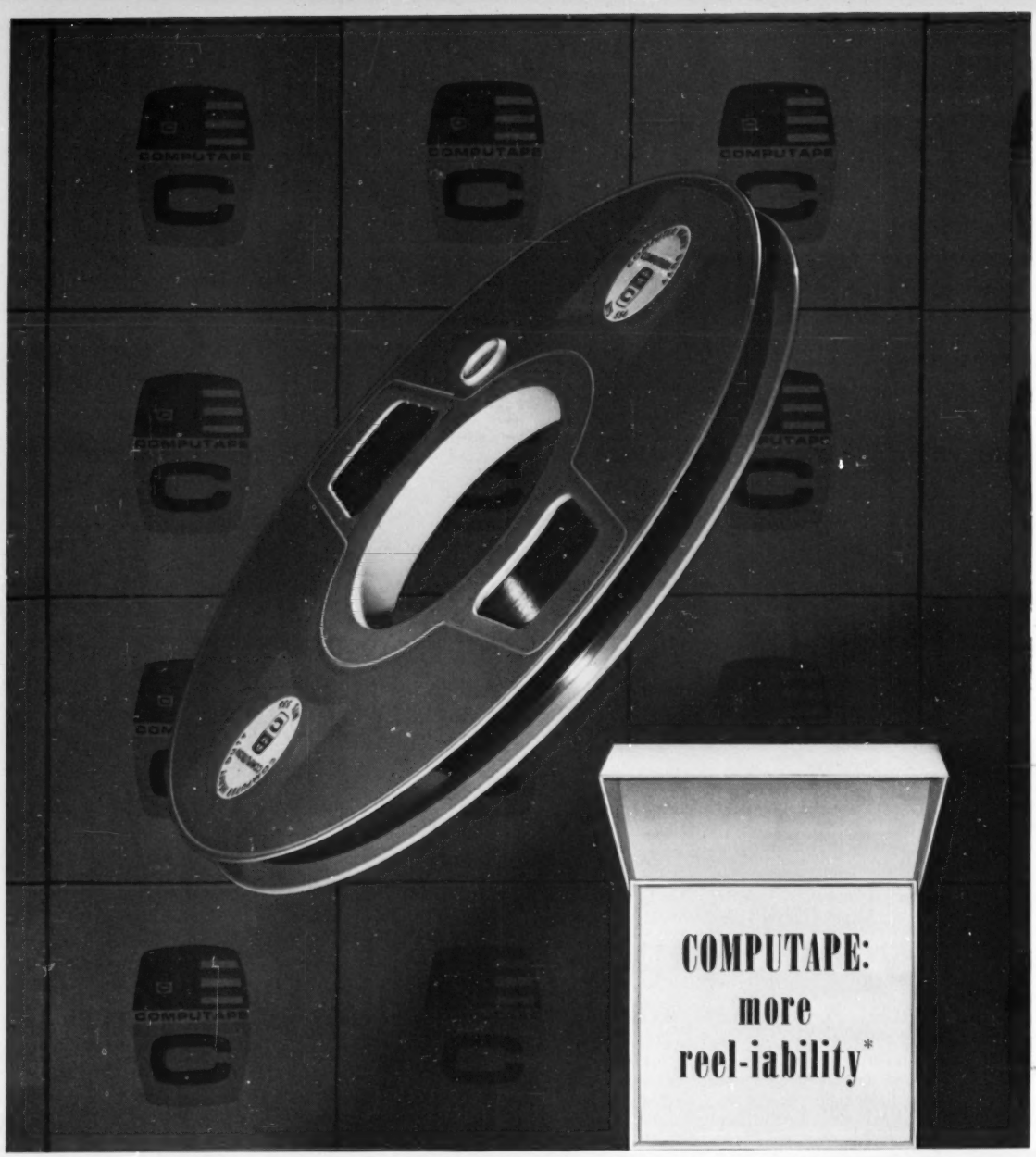
Incidentally, as you may have guessed, it just naturally follows that our Instrumentation Tapes are the finest available!



AMPEX MAGNETIC TAPE PRODUCTS

Opelika, Alabama

CIRCLE 39 ON READER CARD



***REEL-IABILITY** — that quality in tape which reduces computer down-time and operating costs . . . which guarantees (repeat, guarantees) 800 bits per inch with no dropouts in your severest applications. This kind of reliability (no matter how you spell it) you find only in new Computape, a truly premium quality heavy duty computer and instrumentation tape.

COMPUTAPE: the facts

Computape utilizes a new, heavy-duty coating applied to proven Mylar* backing. This revolutionary formulation combines extra heavy duty usage with minimum of wear products. Highly conductive coating prevents accumulation of static charges. Magnetic properties are specifically designed for high density, high resolution data recording, with binders carefully selected to assure non-aging.

Manufactured start-to-finish in completely controlled dust-free facilities (our plant is, as far as we know, the world's newest) Computape is the product of the only company devoted exclusively to the manufacture of quality tapes for data processing and instrumentation.

Investigate Computape today. Better still, immediately.

COMPUTRON INC.

122 Calvary Street, Waltham, Massachusetts

*T. M. DUPONT

Visit us at EJCC—Booth B-15

CIRCLE 42 ON READER CARD

COMPUTER CHARACTERISTICS REVISITED

12 months & 18 new systems later . . .

by NORMAN STATLAND, Vice President, Adams Assoc., Bedford, Mass.

One year ago DATAMATION published the initial version of the Adams Associates Computer Characteristics Chart. Since then, eighteen systems have been announced and their salient features catalogued. There also has been a constant series of minor corrections resulting from equipment modifications and revised interpretations.

These rapid changes, together with the heavy demand for the chart, has at times caused us to wonder whether we are in the publishing business rather than being management consultants primarily in the use of computers. The demand, coupled with the pace of developments, gave evidence that a comprehensive, objective and up-to-date chart would surely fill a continuing need.

Since our original intention of issuing periodic supplements proved unwieldy and the cost of printing the information mounted, we decided to revise the chart each quarter. In February, we added two new columns, "Monthly Rental Range" and "Date First Delivery," and in the current issue five more have been included, "Random Access Capacity," "Average Access Time," Algebraic Compiler," "Business Compiler" and "Program-interrupt." Several of these columns represent our first departure from strictly "hardware" characteristics but have been included since we feel users and prospective users of equipment will value this information.

You will note a change from "Average Access Time" under Central Processor to "Cycle Time," which is defined as the total time to read and restore a word (or character) in core storage and as a full drum revolution for drum storage. This change was dictated by the influx of overlapped core banks in most of the recently announced solid-state computers.

Perhaps the most significant change to be found is in the new format of the remarks and their keys. Each column has been assigned a letter superscript which when used is repeated directly in front of the applicable remark. Prior editions employed a superscript which made the reader find the pertinent phrase to relate to each note. The notational system enables us to point out the use of such items as instruction look-ahead and magnetic tapes with forward and reverse read, as well as characteristics of random access equipment which have been much in the news in recent months.

The latest edition of the Quarterly has been divided into three categories of computers for reference ease. Solid-state, special industry (banking) and vacuum-tube computers have been divided into separate groups to facilitate access to related data and eliminate what may be extraneous material to prospective users of equipment.

It is the intention of the Quarterly to present all pertinent data on computers in a succinct and consistent manner. We recognize that within the column headings we have selected, there are some discrepancies between various systems. Since it is part of our policy to make no evaluations of equipment but rather to present only factual data consistently interpreted for all computers, we have had to exchange countless phone calls, letters and telegrams with equipment manufacturers' representatives. The resolution of what on the surface appears to be unquestionable statements of performance specifications is almost akin to negotiating a disarmament pact.

In fact, the solicitation of information and subsequent editing of what will appear in print is by far the most difficult aspect in the preparation of any publication of this nature. All data submitted by the manufacturers is reviewed by our staff for such questions as: "It is standard equipment? Is the cycle time accurately presented? What does this machine use as indirect addressing?" When a question cannot be answered from an examination of the programming manual, the manufacturer is asked to provide a detailed explanation. Most of the time we reach an agreement consistent with all other facts listed for this column.

It is our hope to expand the circulation of the chart to laymen as well as experts, and to this end we have plans to eventually add columns for bench-mark problems (perhaps polynomial evlauation, binary searching, and merge sorting) that will provide a basis for real comparison (add time and cycle time aren't suitable for this, as we've known all along). We may also add process-control computers and some, if not all, the systems manufactured abroad.

We wish to invite suggestions for future inclusions and improvements. One suggestion we receive fairly often but hesitate to act on is to include for each system the number installed and on order. What is really needed is a suggestion of how to get reliable data – you provide it and we'll publish it. ■

COMPUTER CHARACTERISTICS 1961

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		CENTRAL PROCESSOR				FILE STORAGE					INPUT-OUTPUT EQUIPMENT				OTHER FEATURES					
	Typical Monthly Rental Monthly Rental Range	Date First Delivery	Add Time in Micro-seconds	Cycle Time in Micro-seconds	Storage Capacity and Type	Word Size Instruction Addresses	Thousands of Char-acters per Second Buffering	Maximum Tape Units	Capacity	Average Access Time	In / Out Cards per Minute	In / Out Paper Tape Char-acters per Second	Printer Lines per Minute	Off-line Equipment	Program Interrupt	Index Registers	Indirect Addressing	Floating Point Arith.	Console Typewriter	Algebraic Compiler	Business Compiler
SOLID-STATE SYSTEMS																				
S1 **IBM 7030 STRETCH**	$300,000[A] (200-)	5/61		1	16-262K core	64b 1	62 256 MRWC[J]		2M —[M]	1000 250	—	600	1401	√	16	√	√	I/O	—	—
	A. Computer no longer marketed. C. Instruction look-ahead and overlapped core banks allow increased internal speed. J. Input-output under separate control. M. Access time varies from 51-231 ms depending on file organization.																			
S2 **UNIVAC LARC**	$135,000 (135-)	5/60	4[C]	2	10-97K core	12d 1	25 40 MRWC[J]		6M[L] 68m	N	P	Q	R	—	99	√	√	I/O	—	—
	C. Instruction look-ahead and overlapped core banks allow increased internal speed. J. Input-output under control of a separate computer and it is possible to add a second computing unit. L. Up to 24 drums of 250,000 words each. N, P, Q, R. All UNIVAC peripheral equipment (including high speed film printer) can be used.																			
S3 **IBM 7090**	$64,000 (50-69)	11/59	4.4	2.2	32K core	36b 1	15-62[H] 80 MRWC[J]		280M[L] 180m	250 100	— —	150	1401 same	—	3	√	√	I/O	/59[X]	12/61[Y]
	H. For all 7000 series, 729 II tape units operate at 15K and 41K while 729 IV tape units operate at 22K and 62K. J. Data channel (up to 8) is a separate input-output control. For up to ten tape units each. L. IBM 1301 disc file has 56 million BCD characters per unit (up to five storage units). X. FORTRAN. Y. COBOL '61, COMmercial TRANslator (9/61).																			
S4 **PHILCO 2000 Model 212**	$58,500 (47-49)	/62	.75[C]	2	16-32K core	48b 1[G]	90 256[K] MRWC		1.2M[L] 17m	2000 250[N]	1000 60	900	2400 same	√	8	—	√	I/O	/60[X]	9/62[Y]
	C. Instruction look-ahead (4 level) and asynchronous, overlapped core banks allow increased internal speed. G. Instructions stored two per word. K. Magnetic tapes read in forward and reverse directions. L. Up to 32 drums of 32,768 words each are available. N. 100 cpm punch available. X. ALTAC (Fortran-type). Y. COBOL '61.																			
S5 **IBM 7080**	$55,000 (40-73)	8/61	11[C]	2 1	80-160K core 1K core	1a[F] 1	15-62 40 MRWC[J]		280M[L] 180m	250 100	— —	150	1401 same	√	0	√		O	/61[X]	12/61[Y]
	C. Add time assumes a five-character field. F. A variable-word length computer (see IBM 705 entry V5). J. Simultaneous transmit instruction allows internal transfer of data to be overlapped with other computer operations. L. IBM 1301 disc file. X. FORTRAN. Y. COBOL '61, COMmercial TRANslator (8/61).																			
S6 **RW 400**	$50,000[A] (10-)	3/61	14	10	9K core	26b 2	62 24 MRWC[J]		— —	2000 —	300 —	900[Q]	—	√	√	—	—	I/O	—	—
	A. Speeds, capacities and costs refer to a representative system. J. Data modules are separate controls for tape input-output and search. Q. A complete set of on-line display units are available.																			
S7 **UNIVAC 1107**	$50,000 (40-60)	/62	4[C] .6	4 128 film	65K core	36b 1[G]	25-120 192[K] MRWC		94M[L] 17m	700[N] 400	400 300[P]	600 700	SS80/90	√	15	√	√	I/O	7/62[X]	6/62[Y]
	C. Overlapped core banks and thin film memory usage allow increased internal speed. G. Half-word and multiple six-bit operations permit use of virtual two or three-address instruction logic. K. Magnetic tapes read in forward and reverse directions. L. Each flying head drum unit (8 per subsystem with maximum of 15 subsystems) has a capacity of 786,432 words. N. 600 cpm reader available. P. 110 ch/sec punch available. X. ALGOL. Y. COBOL '61.																			
S8 **CONTROL DATA 1604**	$34,000 (19-35)	1/60	4.8[C]	6.4	8-32K core	48b 1[G]	30 96[K] MRWC		— —	1300 100	350 110	150 1000	160	√	6	√	√	I/O	/60[X]	2/62[Y]
	C. Overlapped core banks allow increased speed. G. Instructions stored two per word. K. Compatible with IBM tape units. X. Fortran. Y. COBOL '61.																			
S9 **RCA 601**	$32,000 (24-68)	9/61	4.7[C] 5.7	1.5[D] 2.5	8-32K core	56b[F] 1-3[G]	33-120 MRWC	63	— —	600 200[N]	1000 300[P]	1000	same	√	8[T]	√	√	I/O	/62[X]	9/62[Y]
	C. Asynchronous, overlapped core banks allow increased internal speed. D. 603 central processor has faster staticizing and address modification than 604. F. Binary and decimal arithmetic instructions included. G. Variable length instructions (1, 2, 3, or 4 half words) operate on character, half-word or word. N. 200 cpm punch available. P. 110 ch/sec. punch available. T. 8 index registers available for each program. X. ALGOL. Y. COBOL '61.																			
S10 **PHILCO 2000 Model 210, 211**	$30,000 (27-66)	11/58	15[C] 3.6[C]	10 2	4-32K core	48b 1[G]	90 256[K] MRWC		1.2M[L] 17m	2000 250[N]	1000 60	900	2400 same	√	32	—	√	I/O	/60[X]	9/62[Y]
	C. Asynchronous, overlapped core banks allow increased internal speed. G. Instructions stored two per word. K. Magnetic tapes read in forward and reverse directions. L. Up to 32 drums of 32,768 words each are available. N. 100 cpm punch available. X. ALTAC (Fortran-type). Y. COBOL '61.																			

	CENTRAL PROCESSOR					FILE STORAGE						INPUT-OUTPUT EQUIPMENT				OTHER FEATURES						
						Magnetic Tape				Random Access												
	Typical Monthly Rental Monthly Rental Range	Date First Delivery	Add Time in Microseconds	Cycle Time in Microseconds	Storage Capacity and Type	Word Size Instruction Addresses	Thousands of Characters per Second Buffering	Maximum Tape Units	Capacity	Average Access Time	In Out Cards per Minute	In Out Paper Tape Characters per Second	Printer Lines per Minute	Off-line Equipment	Program Interrupt	Index Registers	Indirect Addressing	Floating Point Arith.	Console Typewriter	Algebraic Compiler	Business Compiler
S11 **IBM 7074**	$29,300 (17-36)	/62	10[C]	4	5-30K core	10d[F] 1	15-62 RWC[J]	40	280M[L] 180m		500 250	—	150	1401	√	99	√[U]	√	I/O	/61[X]	12/61[Y]
C. Parallel adder circuit increases speed over serial circuit in IBM 7070 (see entry S13). F. Word size is 10d plus sign. J. MRWC possible when four channels used. L. IBM 1301 disc file (see entry S13). U. Indirect addressing limited to scatter-read and gather-write operations. X. FORTRAN. Y. COBOL '61, COMmercial TRANslator (8/61).																					
S12 **UNIVAC 490**	$25,500 (18-)	12/61	4.8 12[C]	6	16-32K core	30b 1[G]	25-125[H] MRWC	192[K]	75M[L] 17m		600 150	1500[P] 110	600 700	—	√	7	—	—	I/O	—	8/62[Y]
C. 4.8μ is add time for repeat mode only. G. Half-word logical operations can be performed. H. Numeric information can be transferred at a rate of 175,000 ch/sec. K. Magnetic tapes read in forward and reverse directions. L. Each flying head drum unit (8 per subsystem with maximum of 12 subsystems) has a capacity 786,432 words. P. 350 ch/sec reader available. Y. COBOL '61.																					
S13 **IBM 7070**	$24,000 (12-31)	6/60	60[C]	10	5-10K core[E]	10d[F] 1	15-62 RWC[J]	40	280M[L] 180m		500 250	—	150	1401	√	99	√[U]	√	I/O	/60[X]	12/61[Y]
C. Add time varies by number of digits in field to be added and does not include indexing time. E. Up to 30K core memory available. F. Word size is 10d plus sign. J. MRWC possible when four channels used. L. IBM 1301 disc file has 56 million 6-bit characters per 25 disc (50 surfaces of which 40 are used for storage) module or 86 million 4-bit characters stored in packed (8-bit) format. Model II 1301's have two modules or 50 discs. U. Indirect addressing limited to scatter-read and gather-write operations. X. FORTRAN Y. COBOL '61, COMmercial TRANslator (8/61).																					
S14 **UNIVAC III**	$22,500 (15-30)	6/62	8	4	8-32K core	6d[F] 1[G]	25-133[H] MRWC	38[K]	√[L] —		700 300	500 110	700[P]	same	√	15	√	√	I/O	—	11/62[Y]
F. Word size is 6d plus sign. G. Instruction may process up to four data words. H. Numeric information can be transferred at a rate of 200,000 ch/sec. K. Magnetic tapes read in forward and reverse directions. L. Specifications not available. P. 928 lpm for completely numeric data. Y. COBOL '61.																					
S15 **HONEYWELL 800**	$22,000 (12-30)	12/60	24	6	4-32K core	12d[F] 3	64[H] MRWC	64[K]	720M[L] 100m		650[N] 250[N]	1000[P]	150 900	same	√	64[T]	√	√	I/O	/61[X]	11/62[Y]
F. Word size is 12d plus sign or 48b with binary and decimal arithmetic instructions included. H. Numeric information can be transferred at 96,000 ch/sec. K. Magnetic tapes read in forward and reverse directions with programmed error correction (Orthotronic count). L. Units of 12 (Bryant) discs contain 45 million BCD characters with increments of 24 discs up to a maximum of 96 discs. N. 240 cpm reader and 100 cpm punch available. P. 200 ch/sec. reader available. T. Up to eight programs can be processed concurrently. X. Fortran-type. Y. COBOL '61, FACT (9/61).																					
S16 **BENDIX G-20**	$20,000 (7.3-35)	4/61	15[C]	6	4-32K core	32b 1[G]	120[H] MRWC	500	23M[L] 90m		650 250	500 100	100	same	√	63	√	√	I/O	/60[X]	/62[Y]
C. All arithmetic operations done in floating-point mode. G. Variable instruction length permits multiple operations. H. Numeric information can be transferred at 240,000 ch/sec. Independent search while computing. L. Bryant disc has capacity for 11.5 million or 23 million 8-bit characters. X. ALCOM. Y. COBOL '61.																					
S17 **BURROUGHS B 5000**	$16,200 (13.5-50)	/62	3[C] 17000	6	4-32K core 32K drum[E]	48b 1-4[G]	24-66 MRWC	16	— —		800[N] 100	—	700	—	—	—[T]	√[U]	√	I/O	/62[X]	/62[Y]
C. Instruction look-ahead and overlapped core banks allow increased internal speed. E. 2 drums available. G. Polish notation allows variable number of operands. N. 200 cpm reader available. T, U. Logical design has stack (working area), Program Reference Table to handle data references plus four modes of central processor: Arithmetic, Subroutine, Data Manipulation, and Control. X. ALGOL. Y. COBOL '61.																					
S18 **RCA 501**	$16,000 (11-26)	11/59	360[C]	15	16-262K core	1a[F] 2	33-66 RC, WC, or RW	63[K]	— —		600 200	1000 100[P]	600 900	same[R]	—	8	√[U]	—	O	—	10/60[Y]
C. Add time assumes five character field. F. Variable-word length computer using four character (tetrad) parallel transfer. K. Magnetic tapes read in forward and reverse directions. P. 300 ch/sec punch available. R. Card equipment and printer may be used off-line. U. Indirect addressing limited to scatter-read and gather-write operations. Y. COBOL '60.																					
S19 **IBM 7072**	$15,800 (14-32)	/62	12	4	5-30K core	10d[F] 1	7.2-20[H] RWC	20[K]	— —		60	—	—	1401	√	99	√[U]	—	I/O	/60[X]	12/62[Y]
F. Word size is 10d plus sign. H. Low-speed magnetic tape only, input-output version of the IBM 7070 (see entry S13). K. IBM 7330 tape units. U. Indirect addressing limited to scatter-read and gather-write operations. X. FORTRAN. Y. COBOL '61, COMmercial TRANslator (8/61).																					
S20 **NCR 304**	$15,000 (12.5-19)	11/59	600 120[C]	60	2-4K core	10a 3[G]	30 RW[J]	64[K]	— —		2000 250[N]	1800 60	680 900	same	—	10	—	√	I/O	—	8/61[Y]
C. Micro-flow, single address instructions. G. Two words per instruction. J. In processing inactive records, RWC is achieved. K. Magnetic tapes have no space between records. N. 100 cpm punch available. Y. COBOL '61.																					
S21 **GENERAL ELECTRIC 210**	$14,000 (10.5-36)	11/60	64	32	4-8K core	6d[F] 1[G]	30 RWC	13	— —		1500[N] 200[N]	200 110	1000[Q]	—	—	1	—	—	I/O	—	—
F. Word size is 6d plus sign. G. Double precision arithmetic instructions included. N. 400 cpm reader and 100 cpm punch available. Two 1200 MICR-document per minute sorter-readers can be multiplexed. Q. Printer can print magnetically encoded characters and also be used off-line.																					

		CENTRAL PROCESSOR					FILE STORAGE Magnetic Tape				Random Access		INPUT-OUTPUT EQUIPMENT In		Out	In	Out		OTHER FEATURES					
	Typical Monthly Rental Monthly Rental Range	Date First Delivery	Add Time in Micro-seconds	Cycle Time in Micro-seconds	Storage Capacity and Type	Word Size Instruction Addresses	Thousands of Char-acters per Second Buffering	Maximum Tape Units	Capacity	Average Access Time	Cards per Minute	Paper Tape Char-acters per Second	Printer Lines per Minute	Off-line Equipment	Program Interrupt	Index Registers	Indirect Addressing	Floating Point Arith.	Console Typewriter	Algebraic Compiler	Business Compiler
S22 CONTROL DATA 924	$10,000[A] (8.7-20)	8/61	9.3[C]	6.4	8-32K core	24b 1	15-30 MRWC	96[K]	— —	—	1300 100	350 110	150 1000	—	✓	6	✓	—	I/O	—	—
A. No rental prices announced. Prices derived from purchase price. C. Overlapped core memory banks allow increased internal speed. K. Magnetic tapes compatible with IBM tape units.																					
S23 HONEYWELL 400	$10,000 (6-15)	12/61	120	10	1-4K core	12d 3	64[H] RW	8[K]	96M[L] 100m	650 250[N]	1000 60	900	—	—	3	—	✓	I/O	—	/62[Y]
H. Numeric information can be transferred at rate of 96,000 ch/sec. K. Magnetic tapes read in forward and reverse directions. L. Bryant discs in increments of 24 million BCD characters. N. 100 cpm punch available. Y. COBOL '61.																					
S24 NCR 315	$8,500 (3.8-30)	1/62	36[C]	6	2-40K core	2a[F] 1	24-60 none	8	88M[L] 200m	2000 250	1000 110	680 900	—	✓	32	—	—	I/O	—	1/62[Y] 5/62[Y]
C. Add time assumes a three-character field. F. Decimal format allows 3d word size. L. Magnetically encoded cards on a drum (CRAM) permit random and sequential file processing. Sixteen units with 5.5 million alphanumeric or 8.3 million BCD characters each. Y. COBOL '61 1/62 – tape. 5/62-CRAM.																					
S25 IBM 1410	$8,000 (6-32)	12/61	110[C]	4.5	10-40K core	1a[F] 2	7.2-62 RWC	20	250M[L] 180m	900[N] 250	500 —	600	—	✓	15	—	—	I/O	/61[X]	/62[Y]
C. Add time assumes a five-character field. F. Variable-length instructions operate on variable length data fields. L. Up to five IBM 1301 disc units available in 25 million or 50 million alphanumeric characters each. N. Optical and MICR readers available. X. FORTRAN. Y. COBOL '61.																					
S26 UNIVAC SS 80/90 Model I	$8,000 (3.5-13)	1/60	85	3400 850	2.4-7.6K drum[E] .2-1.6K Fast	10d[F] 1[G]	25 RC, WC[J]	10	240M[L] 385m	600 150	— —	600	—	—	3	—	—	—	—	/61[Y]
Model II	$8,500	8/62	51	17	1.2K core		12.5-25	20							9						
E. STEP card and tape systems allow increments of 400 words drum and 200 words fast memory. F. Word size is 10d plus sign. G. Last part of instruction word indicates address of next instruction. J. In Model II, which will have core memory and magnetic tape, it is possible to achieve RWC with use of a second synchronizer. L. Up to ten Randex drum units (2 drums) have a capacity of 24 million characters each. Y. COBOL '60 compiled on UNIVAC II.																					
S27 PHILCO 2400	$7,800 —	/62	114[C]	6	8-32K core[E]	1a[F] 1	90 RC, WC or RW	48[K]	— —	—	2250 250[N]	1000 100	900[Q]	—	—[S]	3	—	—	I/O	—	—
C. Add time assumes a five-character field. E. Asynchronous core banks allow increased internal speed. F. Variable length instructions operate on variable length data fields. K. Magnetic tapes read in forward and reverse directions. N. 100 cpm punch available. Q. Numeric information only printed at 1200 lpm. S. Dual program control facility present.																					
S28 GENERAL ELECTRIC 225	$7,000 (2.5-26)	3/61	36	18	4-16K core	20b 1[G]	15-62 MRWC	64	4M[L] 150m	1000[N] 250[N]	1000[P] 110	900	same	✓	96	—	✓	O	3/62[X]	3/62[Y]
L. Telex discs in increments of 98,304 words per 16 disc unit. G. Double precision arithmetic instructions included. N. Two 1200 MICR document-per-minute sorter-reader can be multiplexed. 400 cpm reader and 100 cpm punch available. P. 250 ch/sec reader available. X. ALGOL. Y. COBOL '61 as part of GECOM.																					
S29 IBM 1401	$6,500[A] (2.5-12)	9/60	230[C]	11.5	1.4-16K core	1a[F] 2	7.2-62 none[J]	6	20M[L] 600m	800 250	500 —	600[Q]	—	—	3	—	—	I/O	/61[X]	1/62[Y]
A. Typical rental for magnetic tape system. For card system (see entry 36A). C. Add time assumes a five-character field. F. Variable length instructions operate on variable length data fields. J. Normally only magnetic tape start-stop time may be overlapped with computing but Processing Overlap Feature permits input-output operations to overlap computing. L. IBM 1405 disc with 10 million or 20 million alphanumeric characters each. Q. Numeric information only printed at 1285 lpm. 1404 printer used for printing on cards. X. FORTRAN. Y. COBOL '61.																					
S30 RCA 301	$5,200 (3.3-25)	2/61	189[C]	7	10-20K core[E]	1a[F] 2	7.5-66 RC, WC, or RW	14[K]	176M[L] 100m	600 200[N]	1000 100	1000	—	—	1	✓	—	—	—	3/62[Y]
C. Add time assumes a five-character field. E. A 320 character position table is used for arithmetic operations in place of adder circuits. F. Variable length data fields. K. Magnetic tapes read in forward and reverse directions. L. Up to two units four modules of 22, 44, 66 and 88 million alphanumeric characters each available or up to six record files of 4.6 million characters each also available. N. 100 cpm punch available. Y. COBOL '61.																					
S31 RPC 9000	$4,500 (2.5-10)	/61	230	1760	72-264 delay	12a 1[G]	52[H] MRWC[J]	120	1M[L] —	400 —	500[P] 300[P]	150 1000	—	—	0	—	—	I/O	—	—
E. Internal storage is magnetostrictive delay lines. G. One operation character and one address character make up each instruction. H. Calculated search speed only. J. Buffer size may be expanded in two block units. L. Continuously moving magnetic tape loops accommodate random access files of 50,000 to 1,000,000 characters, access time varying from .1 to 2.0 sec. depending on loop length. P. 30 ch/sec punch and 60 ch/sec reader are available.																					
S32 CONTROL DATA 160A	$4,000 (2.2-9.5)	7/61	12.8	6.4	8-32K core	12b 1	15-30 RC, WC or RW[J]	40[K]	— —	—	1300[N] 100	350 110	150 1000	—	✓	0	✓	—	I/O	/62[X]	—
J. Buffered version of CDC 160 (see entry S 40). K. Magnetic tapes compatible with IBM tape units. N. 100 cpm reader available. X. FORTRAN.																					

	CENTRAL PROCESSOR					FILE STORAGE					INPUT-OUTPUT EQUIPMENT			OTHER FEATURES						
						Magnetic Tape Random Access													
	Typical Monthly Rental Monthly Rental Range	Date First Delivery	Add Time in Micro-seconds	Cycle Time in Micro-seconds	Storage Capacity and Type	Word Size Instruction Addresses	Thousands of Characters per Second Buffering	Maximum Tape Units	Capacity Average Access Time	In Out Cards per Minute	In Out Paper Tape Characters per Second	Printer Lines per Minute	Off-line Equipment	Program Interrupt	Index Registers	Indirect Addressing	Floating Point Arith.	Console Typewriter	Algebraic Compiler	Business Compiler
S33																				
DEC PDP-1	$3,600[A] (2.9-15)	11/60	10	5	1-16K core	18b 1	15 MRWC[J]	64	— —	100[N] 100	400 60	600[Q]	—	√	0	√	—	I/O	12/61[X]	—
	A. No rental prices announced. Prices derived from purchase price and do not include cost of magnetic tape units. J. Up to 16 high speed input-output channels may be connected. N. 2000 cpm reader available. Q. Cathode ray tube display with light pen available. X. DECAL (Algol-type).																			
S34																				
AUTONETICS RECOMP II	$2,500[A] (2.5-4.5)	11/58	1008	9000 950	4K disc 16 fast	40b[F] 1[G]	18 none	8	— —	60	600[P] 150[P]	20	—	—	0	—	√	I/O	—	—
	A. Price does not include cost of magnetic tape units. F. Instructions stored two per word. G. Square root and absolute value instructions included. P. 400 ch/sec reader and 20 ch/sec punch available.																			
S35																				
COMPUTER CONTROL DDP-25	$2,500[A] (2.3-)	5/61	8[C]	5	4-16K core	24b 1	15-62 RWC	16[K]	— —	400 100	1000 100	600	—	√	1	—	—	I/O	—	—
	A. No rental prices announced. Prices derived from purchase price and do not include cost of magnetic tape units. C. Overlapped core banks allow increased internal speed. K. Magnetic tape units compatible with IBM tape units.																			
S36																				
RW AN/UYK-1	$2,500[A]	8/61	12	6	8-32K core	15b 1-3	15-30 none	4	— —	—	300 110	—	—	—	—[T]	—[U]	—	I/O	—	—
	A. No rental prices announced. Prices derived from purchase price and does not include cost of magnetic tape units. T, U. Index registers and indirect addressing available through micro-commands or "logands" portion of stored logic.																			
S36a																				
IBM 1401	$2,500[A] (2.5-3.6)	9/60	230	11.5	1.4-4K core	1a[F] 2	—	—	— —	800 250	—	600	—	—	3	—	—	—	—	6/62[Y]
	A. Card input-output version of entry S29. Y. COBOL '61.																			
S37																				
RPC 4000	$1,900 (1.8-4.5)	11/60	1000	17000 10000	8K drum[E] 128 fast	32b 1[G]	—	—	— —	—	500[P] 300[P]	—	—	—	1	—	—	I/O	/61[X]	—
	E. Drum offers dual access with two read-write heads operating in two tracks, and eight words of 1000μ access storage. G. The last half of the instruction word indicates the address of the next instruction. Repeat command allows groups of up to 128 words in memory to be operated on by one command at 250μ per word. P. 60 ch/sec reader and 30 ch/sec punch available. X. FORTRAN.																			
S38																				
IBM 1620	$1,600[A] (1.6-5)	/60	560	20	20-100K core	1a[F] 2	7.2-15 none	6	10M 585m	250 125	15 10	—	1401	—	3	√	—	I/O	/60[X]	—
	A. Price does not include cost of magnetic tape units. C. A 320 character position table is used instead of adder circuits. Add time assumes a five-character field. F. Variable-word length. X. FORTRAN.																			
S39																				
AUTONETICS RECOMP III	$1,500 (1.4-3)	6/61	1080	9300 1750	4K disc 16 fast	40b 1[G]	—	—	— —	60	600[P] 150[P]	—	—	—	1	—	√	I/O	—	—
	G. Instructions stored two per word. P. 10 ch/sec reader and 10 ch/sec punch available.																			
S40																				
CONTROL DATA 160	$1,500[A] (1.5-3)	7/60	12.8	6.4	4K core	12b 1[G]	15-30 none[J]	20	— —	1300[N] 100	350 110	150 1000	—	—	0	√	—	I/O	/62[X]	—
	A. Price does not include cost of magnetic tape units. G. Instructions use no address, direct address, indirect address, and relative address modes. J. Magnetic tape start-stop time may be overlapped with computing. N. 100 cpm reader available. X. FORTRAN.																			
S41																				
PACKARD BELL PB 250	$1,200[A] (1.2-6)	12/60	24	307 12	2.3-16K delay[E] 16 fast	22b 1	2 none	6	— —	400	300[P] 110[P]	500	—	—	1	—	—	I/O	—	—
	A. Price does not include cost of magnetic tape units. E. Internal storage is magnetostrictive delay lines. P. 20 ch/sec reader and 20 ch/sec punch available as is punch card and analog conversion equipment.																			
S42																				
MONROBOT XI	$700 (.7-1)	5/60	9000	12000	1K drum	32b 1	—	—	— —	15[N] 15	20[P] 20	—	—	—	0	—	—	I/O	—	—
	N, P. Facilities for three input and three output devices including teletypewriter and edge-punched card reader.																			

SPECIAL INDUSTRY COMPUTERS (Solid-State)

Banking

SP1																				
BURROUGHS B251 VRC	$4,000[A1] (2.8-4)	9/61	777[C]	10	4.8K core	1a[F] 3	—	—	— —	200[N] 100	—	200[Q]	—	—	0	—	—	—	—	—
250, 270, 280	$6,500[A2]						50	6	—	800	—	700[Q]	—	—	0					
260	3,750[A3]						none		—	300	—									
	A1. Includes Central Processor, Ledger Processor, Sorter-Reader and Card Reader. A2. Model 250 is more powerful version of B251. Model 270 used as bank proofing machine has a 6 tally lister included; Model 280 has magnetic tape unit included. A3. Buffered, punch card only input-output version. C. Add time assumes five-character field. F. Instruction can be up to 12 characters in length. N. Magnetically encoded ledger cards can be read at 180 cpm. MICR documents read at 1560 per minute. Q. 214 lpm on up to three forms.																			

		CENTRAL PROCESSOR					FILE STORAGE						INPUT-OUTPUT EQUIPMENT						OTHER FEATURES				
							Magnetic Tape			Random Access													
	Typical Monthly Rental Monthly Rental Range	Date First Delivery	Add Time in Micro-seconds	Cycle Time in Micro-seconds	Storage Capacity and Type	Word Size Instruction Addresses	Thousands of Char-acters per Second Buffering	Maximum Tape Units	Capacity	Average Access Time	Cards per Minute In Out	Paper Tape Char-acters per Second In Out	Printer Lines per Minute	Off-line Equipment	Program Interrupt	Index Registers	Indirect Addressing	Floating Point Arith.	Console Typewriter	Algebraic Compiler	Business Compiler
SP2																							
NCR 310	$2,450[A] (1.6-6.5)	4/61	12.8	6.4	4K core	12b 1	15-30 none[J]	20	— —	— —	—[N] —	350[P] 110	900	—	—	0	√	—	I/O	—	—
A. Price does not include cost of magnetic tape units. A version of the CDC-160 (see entry S40). N. MICR documents read at 750 per minute. P. 1000 ch/sec reader available.																							
SP3																							
NCR 390	$1,850 (1.4-1.9)	5/61	11300	1200	200 core	12d 4	— —	—	— —	—	15[N] 15	400 17	110[Q]	—	—	0	—	—	I/O	—	—
N. Magnetic ledger card stores up to 200 characters in magnetic strips. Printed information appears on front of card. Q. Programmable printer allows any columnar arrangement on forms and reports.																							
VACUUM TUBE SYSTEMS — Still Widely Used																							
V1																							
UNIVAC 1105	$43,000 (40-55)	9/58	44	8 34000	8-12K core 16-32K drum[E]	36b 2	21 RWC	24[K]	— —	120 —	200 60	—[Q]	—[R]	√	0	—	√	O	—	—
E. Interlace storage arrangement (address locations on drum spaced according to word times) reduces drum access time. K. Magnetic tapes read in forward and reverse directions. Q. On-line display unit available. R. 300 cpm reader, 120 cpm punch and 600 lpm printer available off-line.																							
V2																							
IBM 709	$40,000 (28-)	8/58	24	12 7000	4-32K core 2-8K drum	36b 1	15 MRWC	48	— —	250 100	— —	150[Q]	1401 same	—	3	√	√	O	/59[X]10/61[Y]		
Q. On-line display unit available. X. FORTRAN . Y. COBOL, COMmercial TRANslator (9/61).																							
V3																							
UNIVAC 1103A	$35,000 (25-45)	3/56	44	8 34000	4-12K core 16-32K drum[E]	36b 2	13 none[J]	10[K]	— —	120 —	200 60	—	—[R]	√	0	—	√	O	—	—
E. See E.—UNIVAC 1105 (entry #V1). J. Magnetic tape start-stop time can be overlapped with computing time. K. Magnetic tapes read in forward and reverse directions. R. 300 cpm reader, 120 cpm punch and 600 lpm printer available off-line.																							
V4																							
IBM 704	$32,000 (24-)	4/56	24	12	4-32K core 2-8K drum	36b 1	15 none[J]	10	— —	250 100	— —	150[Q]	1401 same	—	3	—	√	O	/57[X]	—	
J. Magnetic tape start-stop time can be overlapped with computing time. Q. 500 lpm printer available off-line and on-line display unit is available. X. FORTRAN.																							
V5																							
IBM 705 III I & II	$30,000 (18-54)	3/56	86[C] 119[C]	9 17	20-80K core	1a[F] 1	15-62 RWC	60	— —	250 100	— —	150[Q]	1401 same	—	0	√	—	O	/59[X]10/61[Y]		
C. Add-time assumes a five-character field. F. Variable word length can be used as a fixed (five-digit) word. Q. 500 lpm printer available off-line. X. FORTRAN. Y. COBOL, COMmercial, TRANslator (9/61).																							
V6																							
UNIVAC II	$28,000 (25-30)	11/57	200	40	2K core	12a 1[G]	25 RWC	16[K]	— —	— —	— —	—	—[R]	—	0	—	—	I/O	/58[X]11/60[Y]		
G. Instructions stored two per word. K. Magnetic tapes read in forward and reverse directions. R. 240 cpm and 300 cpm card readers, 120 cpm card punch and 600 lpm printer used off-line only. X. Math-Matic. Y. COBOL 60, Flow-matic.																							
V7																							
UNIVAC I	$25,000 (20-30)	3/51	282	242	1K delay[E]	12a 1[G]	13 RWC	10[K]	— —	— —	— —	—	—[R]	—	0	—	—	I/O	—	/57[Y]	
E. Mercury filled tanks are the storage media. G. Instructions stored two per word. K. Magnetic tapes can be read in forward and reverse directions. R. 240 cpm and 300 cpm card readers, 120 cpm card punch, 200 ch/sec paper tape reader; 50 ch/sec paper tape punch and 600 lpm printer used off-line only. Y. Flow-matic.																							
V8																							
BURROUGHS 220	$17,000 (8-35)	12/58	200	10	2-10K core	10d[F] 1	25 none[J]	10	500M —[M]	300 100	1000 60	150[Q] 1500[Q]	—	—	1	—	√	I/O	/59[X]	—	
F. Word size is 10d plus sign. J. Magnetic tapes with addressable blocks can be searched concurrently with computer operations. M. Access time to tape loops is 1-9 seconds (dependent on size of file). Q. Printers buffered for on-line use and can be used off-line. X. ALGOL '58.																							
V9																							
UNIVAC FILE COMPUTER I Model II	$15,000 (8-21)	1/58 1/62	8600 3400	900 5000 630	20 core 1K drum[E] 2K core	12a 3	10.4 MRWC	10[K]	1.8M[L] 17.6m	150 150	200 60	600[Q]	same[R]	√	0	—	—	I/O	—	—	
E. In Model II, core memory is used instead of drum. K. Off-line sort-collate unit available. L. Up to ten Randex drums (6 million characters each — 385m average access time) may be attached. Q. 800 lpm for pure numeric data. R. 240 cpm reader and 120 cpm punch available off-line.																							
V10																							
IBM 650	$9,000 (3.7-16)	11/54	700	4800 100	1-4K drum 60 core	10d[F] 1[G]	15[H] RC, WC	6	48M[L] 600m	155 100	60 —	150[Q]	—	—	3	—	√	—	/57[X]	—	
F. Word size is 10d plus sign. G. Address of next instruction indicated in last part of instruction. H. Tapes written in BCD (six-bit) or numeric (four-bit) format. L. Up to four Ramac disc files can store 12 million characters each. Q. Printer can be used off-line. X. FORTRAN SIT.																							
V11																							
BURROUGHS 205	$8,000 (2-17)	7/54	1700	17000 1700	4K drum 80 fast	10d[F] 1	6 none[J]	10	50M m	300 100	540 60	150[Q]	—	—	1	—	√	I/O	/59[X]	—	
F. Word size is 10d plus sign. J. Magnetic tapes with addressable blocks can be searched concurrently with computer operations. M. Access time to tape loops is 2-17 seconds (dependent on size of file). Q. Printer buffered for on-line use (CARDATRON) and can be used off-line. X. ALGOL '58.																							

	Typical Monthly Rental / Monthly Rental Range	Date First Delivery	Add Time in Microseconds	Cycle Time in Microseconds	Storage Capacity and Type	Word Size / Instruction Addresses	Thousands of Characters per Second Buffering	Maximum Tape Units	Random Access Capacity	Random Access Average Access Time	Input Cards per Minute	Output Cards per Minute	Input Paper Tape Characters per Second	Output Paper Tape Characters per Second	Printer Lines per Minute	Off-line Equipment	Program Interrupt	Index Registers	Indirect Addressing	Floating Point Arith.	Console Typewriter	Algebraic Compiler	Business Compiler
V12																							
EL-TRONICS ALWAC III-E	$3,600[A] (1.6-4)	/55	1000	8000	4-8K drum	33b[F] 1[G]	21 RC, WC	16[K]	— —	— —	100 100		200 60		150	—	—	1	—	—	I/O	—	—
A. Does not include cost of magnetic tape units. F. Half and quarter word operations are possible. G. Two, three or four instructions may be contained within one word. K. Magnetic tapes can be searched with computer operations.																							
V13																							
IBM 305 RAMAC Model I Model II	$3,600[A] (2.8-6.5) (1.8-)	12-57 3/62	30000 50000	50000	100 core 2K drum	1a 2[G]	15 RC, WC	4	6-40M 600m 5M 600m		125 100 80 50		60		30-50[Q] 150	—	√	0	—	—	I/O	—	—
A. Does not include cost of magnetic tape units. C. Input editing, logical decisions and character analysis usually made through the 305 control panel. Q. "Stick" printer prints one character at a time.																							
V14																							
BENDIX G-15	$1,500[A] (1.5-4)	8/55	1080	29500 1080	2K drum 16 fast	29b 1[G]	43 RC, WC	4	— —		100 100		400 100		100[Q]	—	—	0	—	—	I/O	8/60[X]	
A. Does not include cost of magnetic tape units. C. Address of next instruction indicated in last part of instruction. Q. Analog devices, graph plotter and digital differential analyzer accessories available. X. ALGOL.																							
V15																							
RPC LGP-30	$1,300 (1.1-2)	9/56	2260[C]	17000	4K drum[E]	31b 1	—	— —	— —	— —	— —		200 20		—	—	—	0	—	—	I/O	/59[X]	
C. Minimum execution time for any instruction. E. Interlace storage arrangement (address locations on drum spaced according to word times) reduces drum access time. X. ACT I (Fortran-type).																							
V16																							
BURROUGHS E-101	$875[A] (.9-1.400)	/55	50000	20000	220 drum[E]	12d 1	—	— —	— —	— —	— —		20 13		60	—	—	2	—	—	I/O	—	
A. Computer now being marketed as E-103. E. Pinboard serves as instruction storage unit.																							

EXPLANATION OF COLUMN HEADINGS

Typical Monthly Rental: What a customer might pay for a system with basic peripheral equipment and, if available, magnetic tapes.

Monthly Rental Range: The first figure in parentheses is the cost, in thousands of dollars, of the minimum useful configuration. The second figure, where given, is the approximate cost of the maximum configuration likely to be ordered.

Add Time: Time required to acquire and execute one add instruction in millionths of a second. In drum machines, where add is lower than cycle time, maximum optimization has been assumed.

Cycle Time: Storage cycle time (including, for core storage, the total time to read and restore and for drum storage, a full revolution in millionths of a second).

Storage Capacity and Type: Number of words or characters of addressable internal storage available, K representing thousands. (Example: "32K core" for the IBM 7090 indicates that 32,000 words of magnetic core are available.) "Fast" indicates a serial type area of fast access secondary storage.

Word Size: Number and type of digits comprising one storage word (a = alphanumeric, 6, 7 or 8 binary digits, depending on parity and addressing logic: d = decimal, 4 binary digits; b = binary, 1 binary digit).

Instruction Address: Number of separate storage addresses in a conventional instruction.

Thousands of Characters per Second: Transfer rate between computer and magnetic tape, measured in six-bit characters (one alphabetic, one decimal, or six binary digits) unless otherwise noted.

Buffering: Combinations of reading magnetic tape (R), writing it (W), and computing (C) can be performed simultaneously. (M) indicates that multiple simultaneous operations are possible.

Maximum Tape Units: Maximum number connectable to and addressable by the computer.

Random Access Capacity: Maximum number of words or characters available (M representing million) in an external mass storage unit such as tape loop, drum or disc. Remarks indicate incremental units and characterstics of storage unit.

Average Access Time: Time required to locate a single record, including read-write head positioning and normal rotational access time (i.e., half the revolution time for drum and disc storage).

Peripheral Equipment: Speed of punched card, punched tape and line printer equipment available. For card and tape, the prime input equipment is listed above and prime output equipment below. Additional equipment is mentioned in the remarks if available. The column headed "Off-line Equipment" refers to a smaller satellite computer which can process data off-line ("same" means the on-line equipment can also be used off-line).

Other Features: Check indicates the special feature is obtainable. For index registers the maximum number available is shown. For console typewriters, O refers to a device capable of printing alphanumeric characters at the console; I/O refers to a console keyboard capable of supplying data to computer and actuating the printing device. Floating point arithmetic can be programmed in any system, even though not a built-in feature; but only the latter is indicated.

Algebraic Compiler and Business Compiler: Dates indicate the availability of a compiler and remarks indicate its name (e.g., COBOL '61 means English language compiler representing 1961 specifications of COmmon Business Oriented Language).

ABOUT THE QUARTERLY

The 61 general purpose, stored-program computers published in this chart are updated on a quarterly basis and are available both as a pocket size booklet with plastic cover as well as on 8½ x 11" sheets. The price of the Computer Characteristics Quarterly is $2.50 per issue or $7.50 for a yearly subscription. Inquiries and subscriptions should be directed at the publisher: Charles W. Adams Assoc., 142 The Great Road, Bedford, Massachusetts. (See following page for manufacturers' index.)

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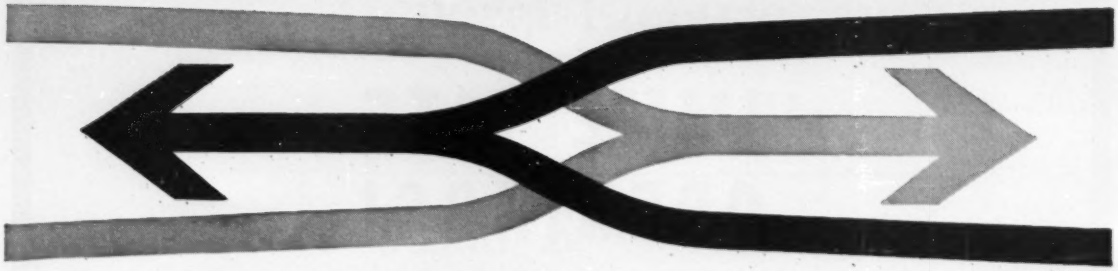

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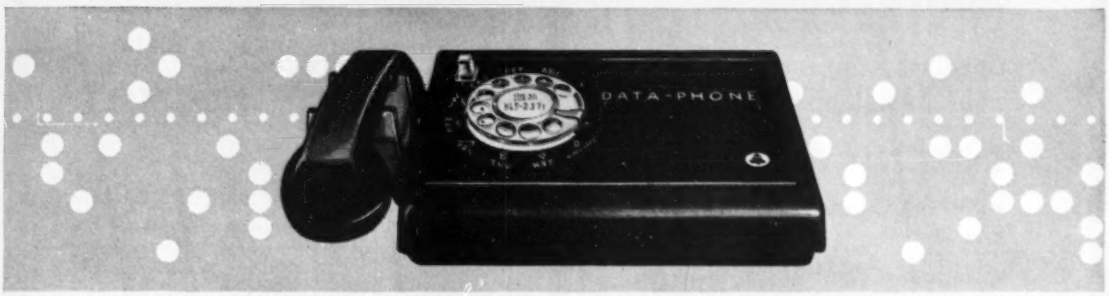

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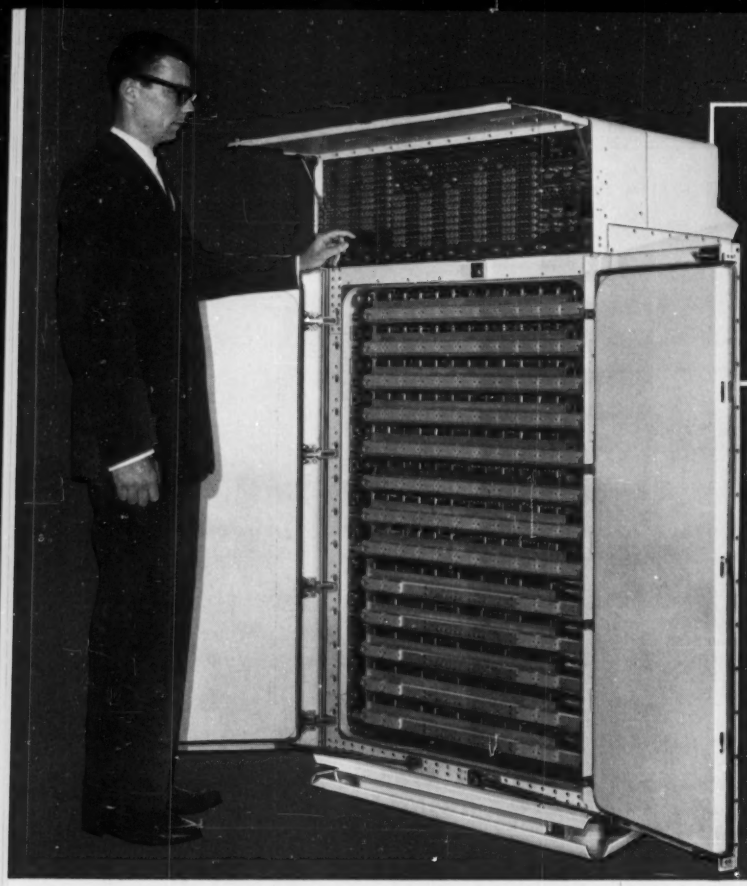

UNIVAC 1

UNIVAC 1206
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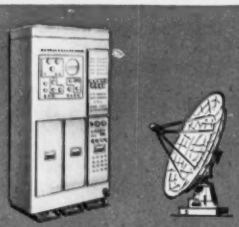
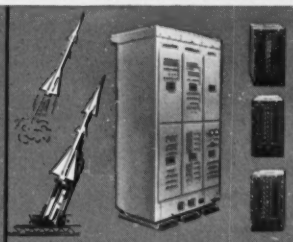
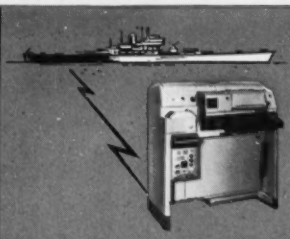


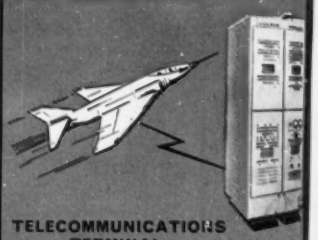
VIDEO PROCESSOR



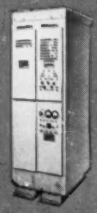
DIGITAL-ANALOG CONVERTER



TELETYPEWRITER SET



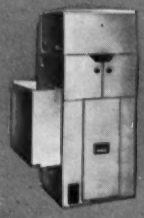
TELECOMMUNICATIONS TERMINAL



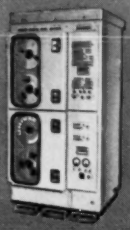
KEYSET CENTRAL

UNIVERSAL KEYSET

PROGRAM DISPLAY



PAPER TAPE EQUIPMENT



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EAST VS. WEST

DIAGRAMS VS. EQUATIONS

THE COMPUTER'S ANSWER TO A LONG-STANDING COMPUTER ISSUE.

For a decade East Coast and West Coast computer designers have been using different methods of representing computer logic—the Easterners with diagrams, the Westerners with equations.

$$LBSMI = (LXA1)(LXA2*)(LFCA*) + (LXA1*)(LXA2)(LFCA*) + (LXA1*)(LXA2*)(LFCA) + (LXA1)(LXA2)(LFCA)$$

$$LFCAJ = (LXA1)(LXA2)$$

$$LFCAK = (LXA1*)(LXA2*)$$

In the example illustrated here, the diagram and the equation tell us exactly the same thing. Either represents a serial full adder where the sequence of pulses at the output, LBSM, will represent a serial binary number that is the sum of two serial binary input numbers occurring at LXA1 and LXA2. (The asterisks indicate binary complements; for example, whenever LXA1 is energized LXA1* is not, and vice versa. LFCA is a carry flip-flop.)

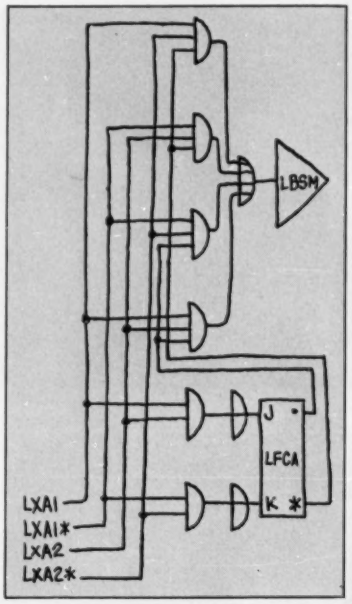
There are persuasive arguments on both sides. Eastern proponents of diagrams point out that the logical interconnections can be seen at a glance and followed through any number of stages by eye. The logical structure of an entire system can be understood from a diagram more directly and intuitively, they maintain, than from a set of equations.

The Western argument for equations goes like this. It's not true that diagrams communicate better to the viewer's intuition, except at first exposure. The human mind is highly adaptive. After working analytically with the equations for a while, the mind begins to operate intuitively in that symbology. Then the intrinsic superiority of equations over diagrams begins to make itself evident. One advantage, say the Westerners, is that equations can represent the same information more compactly and efficiently, as our illustration shows. Another is that equations lend themselves better to computer manipulation of logical design information.

As evidence of the latter advantage Westerners point to a recent achievement of some Litton Systems people: a completely mechanized procedure for translating logical designs into wiring lists, including operational simulation of the design to verify its accuracy. A procedure enormously facilitated by the computerizability of logical equations. It's easy to picture the benefits in cost, delivery schedules, reliability, price. Using only a partial development of this method Litton Systems recently brought a major computer system from concept to operation in less than a year.

Now under consideration at Litton: a machine that will accept as inputs a supply of standard computer components and a set of coded specifications defining the logical functions desired, and will crank out completely fabricated systems.

Maybe you think we've loaded the argument in favor of equations. You're right. But we're ready to listen to arguments on either side. Drop us a card. Or better still, drop in in person. You'll like the



imagination-stretching atmosphere generated by Litton management's appreciation of the rewards of creative controversy. And we have a few excellent opportunities for computer design people. Ask for S. L. Hirsch at Litton Systems, Inc., Data Systems Division, 6700 Eton Ave., Canoga Park, California.

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NEW PRODUCTS

hi-density tape

A high-density magnetic tape system is claimed to be 40 per cent faster, in both the reading and writing of data, than any other tape in current commercial operation. The systems are working at the present time with several H-800s, transferring data to and from tapes at a rate of 133,000 decimal digits per second. A density of 1,112 decimal digits per inch is obtained as compared with 794 decimal digits per inch on standard tapes. MINNEAPOLIS-HONEYWELL REGULATOR CO., EDP DIV., 60 Walnut St., Wellesley, Mass. For information:

CIRCLE 200 ON READER CARD

automatic voice reply

Unicall, a simple alpha-numeric computer input/output device allows a computer to talk back in voice reply to inquiries from hundreds of remote points. Complete messages, up to 40 alpha-numeric digits, can be transmitted from the set over conventional long-distance telephone lines from a computer anywhere in the United States in approximately two seconds and voice reply transmission beginning within a half-second.

Unicall, designed for use with real-time computing systems, can process a message to the computer which selects the appropriate reply from a magnetic drum and sends it back over the telephone lines to the Unicall set in less than five seconds. REMRAND UNIVAC, DIV. OF SPERRY RAND CORP., 315 Park Ave., So., New York 10, N. Y. For information:

CIRCLE 201 ON READER CARD

F-80 option to microfilm recorder

The new F-80 option gives the S-C 4020 microfilm recorder the ability to record multiview engineering drawings, schematics, curves and tabular information on photorecording paper from magnetic tape. The F-80, to be shown at the EJCC, allows production of paper copy and 35mm film simultaneously or individually. GENERAL DYNAMICS, INFORMATION TECHNOLOGY DIV., 1895 Hancock St., San Diego 12, Calif. For information:

CIRCLE 202 ON READER CARD

data communications

Technical or business data can be transmitted by a low cost parallel data communications system on regular dial telephone networks. The equipment was developed for use with Bell's parallel Data-Phone service and can transmit perforated tape at speeds up to 60 characters per second. TALLY REGISTER CORP., 1310 Mercer St., Seattle, Washington. For information:

CIRCLE 203 ON READER CARD

document handler

A new, solid state, high-speed document handler for reading and sorting operations uses magnetic ink character recognition (MICR) at 1900 numbers per second. Standard MICR bank checks and other business documents six to eight inches in length can be processed at the rate of 1,200 per minute. The new machine is designed for on-line application with either the GE 210 or the GE 225 for processing of bank accounts, or it may be used separately for off-line reading and check sorting. The sorter-reader sells for $87,500 and leases for $1,750 monthly. GENERAL ELECTRIC CO., COMPUTER DEPT., Deer Valley Park, Phoenix, Arizona. For information:

CIRCLE 204 ON READER CARD

1.5 microsecond memory

Random access core memory, type LQ, which provides a 1.5 microsecond cycle time, is available for commercial computers. The memory has word lengths up to 56 bits and is being produced in 2048, 4096 and 8192 word modules. Instructions received by the memory through an instruction register can be full word, partial

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word, clear-write, read-regenerate and split cycle.

A full read-restore or clear-write cycle can be completed by the memory in 1.5 microseconds. A split read and write cycle is completed in 1.85 microseconds, and on the read operation, information is gated to the computer in 0.9 microseconds from the beginning of the cycle, with the remainder of the cycle used for the restoration of the information word to its original address.

The LQ features special subminiature ferrite cores, high speed gating circuitry and the use of linear select techniques in which a high current is used to turn the cores, resulting in fast core switching time. AMPEX COMPUTER PRODUCTS, P.O. Box 329, Culver City, Calif. For information:

CIRCLE 205 ON READER CARD

new magnetic tape

A new magnetic tape, known as Computape, utilizes a heavy-duty coating applied to polyester film which is highly conductive and prevents the accumulation of static charges. The magnetic properties are specifically designed for high density, high resolution data recording. COMPUTRON INC., Dept. C-1, 122 Calvary St., Waltham, Mass. For information:

CIRCLE 206 ON READER CARD

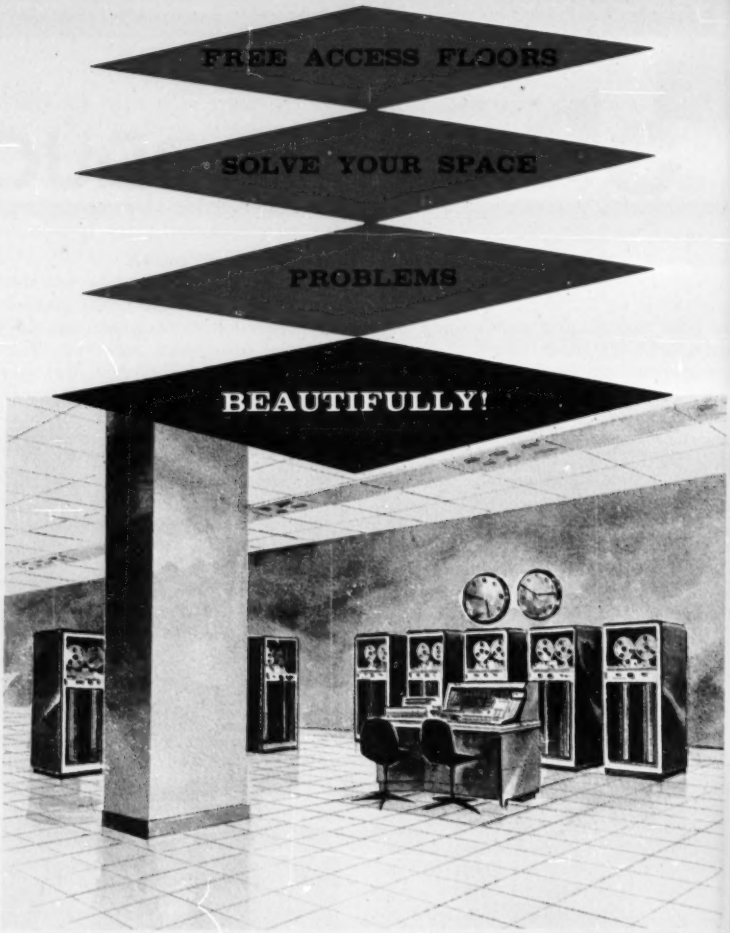
block tape readers

A 400 series of three modular design block tape recorders have been developed for use where panel space is at a premium. One or more of the reader sub-assemblies may be combined with a single control unit to comprise a tape reader for 80, 96 or 120 bit tape frames, or all three selectively, depending on the models of reader sub-assemblies employed. ELECTRONIC ENGINEERING CO. OF CALIF., 1601, East Chestnut, Santa Ana, Calif. For information:

CIRCLE 207 ON READER CARD

G-20 accessories

The LP-12 line printer was designed for use with a G-20 central processor as accessory equipment without requiring special buffering. A line of up to 120 characters can be sent to the printer at any rate up to 67,000 characters per second, along with instructions for printing and paper feed. Another accessory, the DM-10 disc memory unit, employs a parallel-recording technique and will pro-



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vide on-line random access of information from bulk storage modules containing up to 20 million or more 8-bit characters, THE BENDIX CORP., COMPUTER DIVISION, 5630 Arbor Vitae St., Los Angeles 45, Calif. For information:

CIRCLE 208 ON READER CARD

silicon diode

General Electric Co. has entered the semiconductor field with the introduction of the 150 silicon diode to be used for computer circuits. The new switching diode has a minimum conductance of 50 ma at one volt and a recovery time of less than two nanoseconds. GENERAL ELECTRIC CO., SEMICONDUCTOR PRODUCTS DEPT., Electronics Park, Syracuse 1, N. Y. for information:

CIRCLE 209 ON READER CARD

iterative analog computer

An iterative analog computer, the 3200, features compact modular packaging and .01% computing components. The 3200 incorporates a .05% solid state multiplier and stored program function generators. Meter sensitivity of 300, 100, 30, 10, or 3 volts and null positions are obtained by pushbutton selection. SYSTRON-DONNER CORP., DONNER SCIENTIFIC DIV., Concord, Calif. For information:

CIRCLE 210 ON READER CARD

1040 word master

A transistorized word master, model 1040, has a 40 bit capacity as a word generator and display, and operates at frequencies up to 500 kc. The 1040, priced at $1,950, has a choice of automatic or manual key input and NRZ or pulsed output with amplitude control and sync signals variable from 0-20 volts. DIGITAL ELECTRONIC CORP., 161 Sullivan Lane, Westbury, L. I., N. Y. For information:

CIRCLE 211 ON READER CARD

flying magnetic heads

Two series of flying magnetic heads, designed on a proprietary, non-contact, start-stop, double-reed principle, are available in standard cylindrical head configurations. The series 25000 heads provide up to 32 tracks per inch and series 10000 heads provide up to 64 tracks per inch. The double-reed design incorporates an adjustment screw for setting heads and matching playbacks while the drum is operating and an adjustable stop which prevents the head from con-

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CIRCLE 300 ON READER CARD

NEW PRODUCTS . . .

tacting the drum surface. BRYANT COMPUTER PRODUCTS, Walled Lake, Mich. For information:
CIRCLE 212 ON READER CARD

magnetic core memories

An eight-level series of magnetic core memories used for the design of data conversion and dp systems, have a capacity of 128-2048 characters. The speed between load and unload commands is 200 kc or 5 microseconds. ELECTRONIC ENGINEERING CO. OF CALIF., 1601 E. Chestnut Ave., Santa Ana, Calif. For information:
CIRCLE 213 ON READER CARD

bar chart recorder

The Bar Chart Recorder which monitors and records the efficiency of utilization of up to 40 dp machines operates remotely from production areas and provides cost and production control information on a continuous bar chart. The recorder samples and graphically records each machine's performance every 20 seconds and is available with charting time of 9, 17, or 24 hours per chart. ELECTRONIC ASSOC. INC., Long Branch, N.J. For information:
CIRCLE 214 ON READER CARD

plug-in card

The CD-1 plug-in card is a high power, 200 kc clock driver circuit for digital electronic systems and for driving medium power indicator lamps or relays. Each card contains six independent circuits and each circuit can handle 450 ma at 50 per cent duty cycle. COMPUTER LOGIC CORP., 11800 W. Olympic Blvd., Los Angeles 64, Calif. For information:
CIRCLE 215 ON READER CARD

multiverter converter

The model M3 multiverter analog to digital converter provides an illuminated display of three decimal digits plus sign, with an accuracy of conversion within 0.05%±½ least significant bit and an operating rate of 8000 conversions per second for decimal output. The M3, available as a 13-bit model, is offered for analog inputs from ±1 to ±100 volts. PACKARD BELL COMPUTER CORP., 1905 Armacost Ave., Los Angeles 25, Calif. For information:
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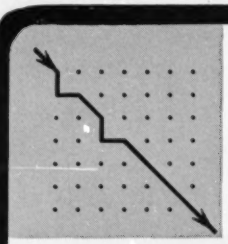
micrologic elements

The micrologic gate and half-shift register have been added to the fam-



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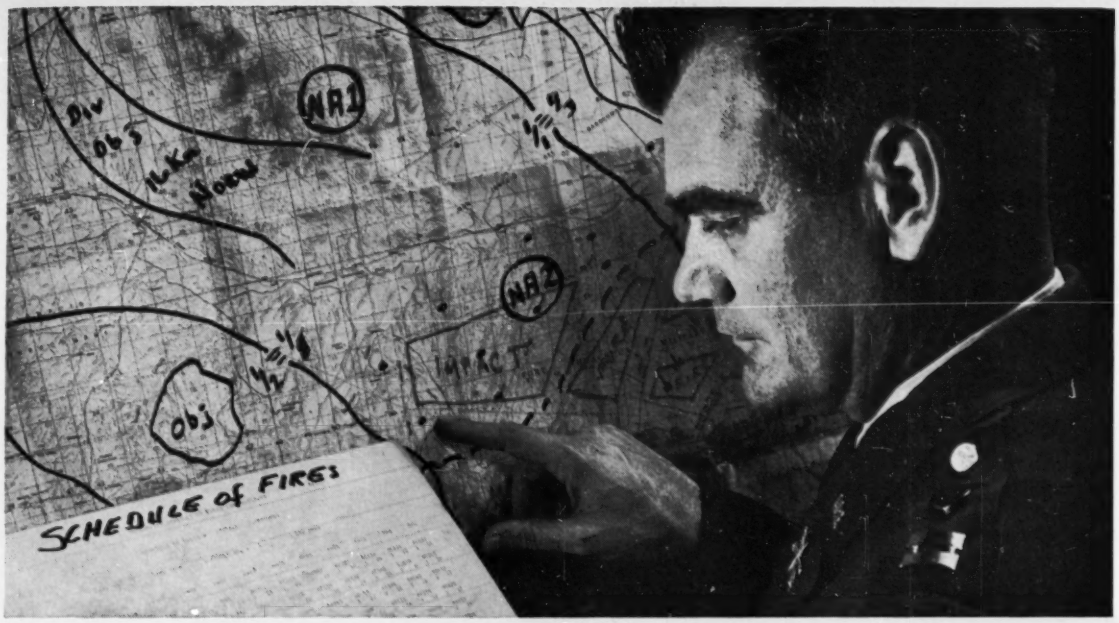
CIRCLE 86 ON READER CARD



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At recent exercises, an Army-Industry team successfully demonstrated that automatic data processing systems can help to reduce the time it takes to prepare a Divisional Fire Plan from a matter of hours to a matter of minutes. When computers process ballistic solutions at electronic speeds, they aid in achieving first-round target hits. This means saving ammunition—conventional or nuclear. It also means surprise—hitting the target while it is unprepared and vulnerable. The long-range program of developing Command Control Information Systems is now being extended to other Tactical Field Army functions, utilizing the FIELDATA family of equipment.

Development and testing of artillery fire planning and control systems are being done by the U.S. Army Electronic Proving Ground, Fort Huachuca, Arizona, with the cooperation and support of the U.S. Army Artillery and Missile School, Fort Sill, Oklahoma. Technical assistance is being provided by Ramo-Wooldridge, a Division of Thompson Ramo Wooldridge Inc.

Challenging openings now exist at Ramo-Wooldridge's Fort Huachuca office for experienced computer programmers, systems analysts and test and applications engineers. All qualified applicants will receive consideration for employment regardless of race, creed, color or national origin.

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ily of microminiature integrated circuits called micrologic elements. Using the complete family of six micrologic elements, computer manufacturers may be able to affect a "90 percent reduction in the size and a 70 percent reduction in the cost" of logic sections, the manufacturer states. FAIRCHILD SEMICONDUCTOR, 545 Whisman Rd., Mountain View, Calif. For information:

CIRCLE 217 ON READER CARD

ferrite memory core

A new true square loop ferrite memory core in 30 mil size, for use in coincident current memories, makes possible the dropping of cycle time to two or three microseconds in large computer coincident current core memories. The new unit requires full read and write current of less than 600 milliamperes. FERROXCUBE CORP. OF AMERICA, Saugerties, N.Y. For information:

CIRCLE 218 ON READER CARD

low-cost RAMAC

A low-cost version of the RAMAC 305, has been designed to meet the needs of organizations with a relatively small volume of data to be processed. The model 2 can handle a typical job approximately 70 percent as fast as the model 1, with a rental cost of $1,000 less than the model 1. The new system reads up to 80 and punches up to 50 cards a minute and stores five-million alphanumeric characters. IBM, DP DIV., 112 East Post Rd., White Plains, N.Y. For information:

CIRCLE 219 ON READER CARD

card reader

Datatran, an all-purpose punched card reader, is small enough to be packaged within computers or can be included in systems for data collection and data transmission to read punched cards at the rate of 50 per minute. DASHEW BUSINESS MACHINES, INC., 3655 Lenawee Ave., Los Angeles 6, Calif. For information:

CIRCLE 220 ON READER CARD

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CIRCLE 221 ON READER CARD

core memory system

A new series of transistorized random-access, magnetic-core memory systems have a storage capacity ranging from 20 480 bits to 163 840 bits. Using 1-mc S-PAC digital modules, access times of 2.5-4.0 μ sec and read-write cycle times of 5-10 μ sec can be obtained. COMPUTER CONTROL CO., 983 Concord St., Framingham, Mass. For information:

CIRCLE 222 ON READER CARD

bank sorters

Two machines for the banking industry process checks at speeds up to 1,600 a minute and postal money orders at speeds up to 1,960 a minute. The 1419 magnetic character reader feeds checking account information directly into a computer, while the 1219 reader-sorter is used for check processing independent of a computer. IBM, DP DIV., 112 East Post Rd., White Plains, New York. For information:

CIRCLE 223 ON READER CARD

paper and mylar tape punch

A new tape punch, the model P76, can punch 5, 6, 7, and 8-channel paper or Mylar-aluminum tape at the rate of 20 characters per second. The P76 has a power-operated back space for error correction; an enclosed, jam-proof chad disposal box and completely enclosed tape supply (1,000 ft.) and take-up (400 ft.) reels. SYSTEMATICS, A DIV. OF GENERAL INSTRUMENT CORP., 3216 West El Segundo Blvd., Hawthorne, Calif. For information:

CIRCLE 224 ON READER CARD

medium speed printer

A medium speed printer, capable of printing 100 characters or the average line of type in one second, can produce up to six clear carbons. Type font consists of 64 discreet characters on a drum, made up of eight discs, each having eight characters. Seven-eighths of a cycle is required to position the selected type character and one-eighth to print. SOROBAN ENGINEERING, INC., Box 1717, Melbourne, Fla. For information:

CIRCLE 225 ON READER CARD

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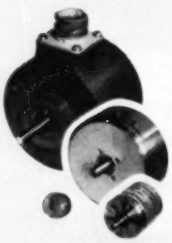
Here are some of the facts . . . you be the judge.



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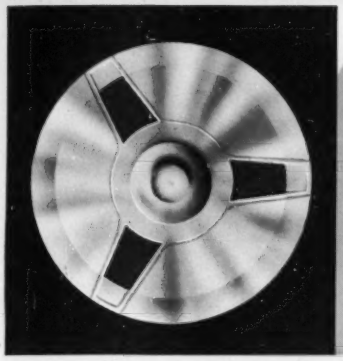

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ACM's BUSINESS DP GROUP VIES FOR EXPANSION

The National Committee for Business Data Processing, ACM, is sponsoring the movement to form The Special Interest Group for Business Data Processing (SIGBDP), as a semi-independent membership group within the framework of the national ACM organization. Petitions for this status will be submitted to the ACM Council at either the EJCC or the Spring JCC.

This move was initiated at the "Business Data Processing Hall of Discussion" at the September ACM meeting in Los Angeles. A proposed set of by-laws for the new organization was adopted.

Among suggestions made for formal activities, it was recommended that the National BDP group serve as a professional sounding board for proposed business-oriented computer systems such as COBOL. The prime responsibility of SIGBDP as a whole, and each member separately, will be to foster goodwill with other professional groups, advance business data processing as a profession, and in general lend direct support to the professional and ethical endeavors necessary for improved stature and prestige.

Members of the National Committee, serving until the new Group is formally organized, are: John A. Postley (Chairman), Advanced Information Systems, Los Angeles; Robert W. Alexander, Army Fitzimons General Hospital, Denver; Arnold P. Anex, Advanced Information Systems; and Murray L. Lesser, IBM, New York.

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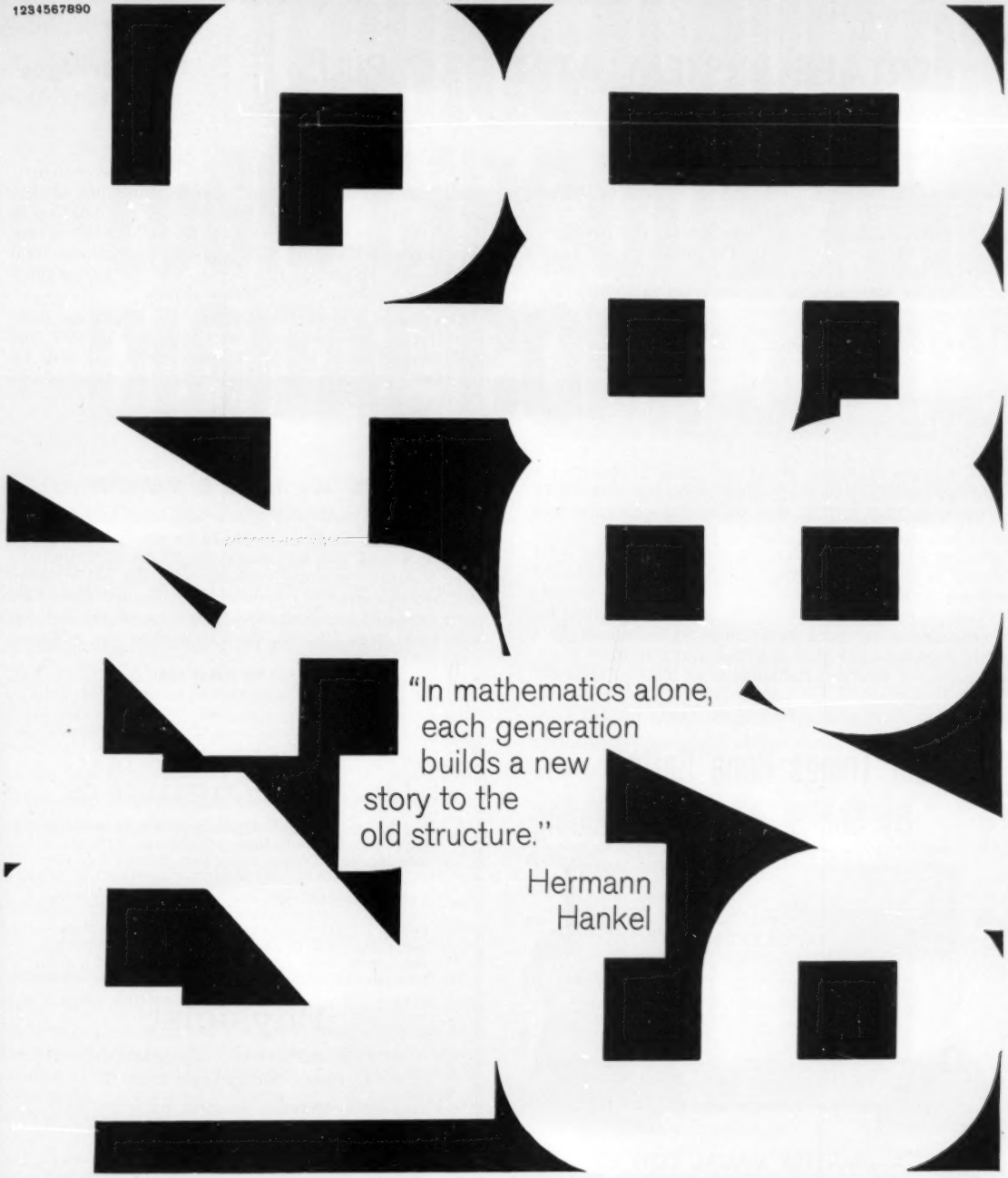

IBM mathematicians and programmers are doing work today that will still have meaning years from now.

They are, for example, teaching computers to work out proofs for theorems in Euclidean geometry. They are applying new techniques to problems in symbolic logic originally outlined by Russell and Whitehead. They are crossing into frontier territory in the fields of automatic storage allocation . . . design automation . . . multi-programming...lexical processing...and in almost every other area of applied and applications programming.

IBM regards programming and programming research as essential to its future growth. At IBM, mathematicians and programmers have at their disposal the machine time they need for the full development of their ideas. And they have before them unusual opportunity for professional growth and personal advancement.

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IBM announces

HYPERTAPE SYSTEM AT 170KC PLUS . . . in cartridges

Hypertape, a new system announced late last month by IBM employs a cartridge-loading technique at speeds ranging from 170KC to 340KC for the 7074, 7080 and 7090.

The units which comprise Hypertape are the 7340 tape drive and 7640 control. With this equipment the 7074 and 7080 can read and write numerals up to 340KC or letters at 170KC, or alphanumeric characters up to 250KC. The 7090 can perform all functions at the 170KC rate. Previously, IBM's 729 tape drives operated at a maximum of 62KC.

Among the features of the new magnetic tape system are cartridge loading; a new method of data recording, error detection and correction, and an advanced mechanism that moves the tape without touching its recording surface.

An operator loads the Hypertape drive by inserting a cartridge containing two tape reels into a slot at the front of the unit. The machine then operates the cartridge and gauges the tape. The complete loading operation requires less than 20 seconds. Unloading can occur at any point during processing since the cartridge may be removed without rewinding.

Two of the 10 channels of the tape are reserved for checking errors recorded in the other eight channels. In a phase encoding method of detection and correction, a signal pattern is recorded continuously on the two channels. An error is detected by any variation of this signal.

Magnetic tape developed for the Hypertape system is wider (1" instead of ½") and shorter than tapes used in the 729 tape drive. Each 1800 foot reel can hold up to 25,000,000 characters and as many as 20 7340 drives may be attached to the 7074, 7080, or 7090 through one 7640 control unit. Hypertape drives may also be incorporated into present systems with 729 tape drives.

Developed at Poughkeepsie, the 7340 Hypertape drive rents for $1,300 per month and sells for $78,000. The 7640 control rents for $3,400 per month and sells for $218,000. First deliveries of the new system are scheduled for the second quarter of 1963.

CIRCLE 118 ON READER CARD

RCA BOOSTS 301 TAPES & MEMORY

A nine-fold increase in magnetic tape speeds and a core memory with twice the capacity of the present 301 system was announced late last month by RCA's EDP division. Tape stations previously available with the 301 operated at 7,500 characters per second while the new units have been increased to about 66KC. Memory of the 301 has been rated from 10-20K. The advanced system will have a capacity of 40K.

CIRCLE 117 ON READER CARD

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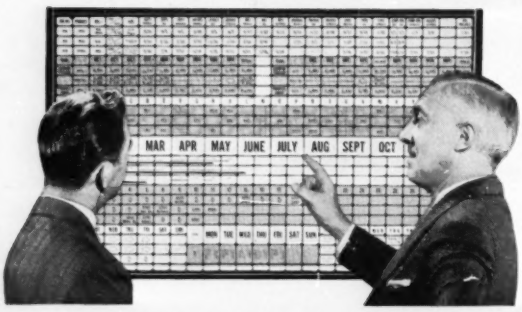

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CIRCLE 301 ON READER CARD

COMPUTING PROGRESS IN GREAT BRITAIN

an advantage lost

By R. H. Williams & E. E. Williams, Computer Consultants, Ltd., London

When computers were first conceived, we in Britain had the same opportunities as did our cousins across the Atlantic. Without question, we have failed to take full advantage of our initial opportunities.

The fault does not lie in any lack of fundamental ideas of computer design and logic, but in the follow-up of original ideas and the exploitation of their possibilities. There is no question that the ability is there, given the right encouragement and the required facilities.

For a long time American computer manufacturers did not believe that such a ripe, rich computer market existed in Britain. Now that they have realized this is so, they are losing no time in taking advantage of the situation and the whole of the computer activity in Britain is in the course of becoming American dominated.

To try and place things into perspective, let us look at some facts and figures, some of which are published for the first time in the latest addendum of the British Commercial Computer Digest.

It was recently announced by J. D. W. Janes of H. M. Treasury Organization and Methods Division at the Data Processing Symposium in London that the British Government had now installed eighteen computers and that nine more were on order! The American Government has installed nearly 900 computers and by 1962 this figure will be well over 1,000. Furthermore, the majority of these computers are large machines.

There are at present installed in Britain 259 computers; 216 of these are of British origin of an estimated value of slightly less than $50,400,000, and 43 of them are of foreign origin of an estimated value of $21,000,000.

There are on order in Britain 261 computers, 122 of which are of British origin, worth about $56,400,000 and 139 of foreign origin worth about $21,000,000. The figures for British orders are in most probability, completely up to date at this moment.

The list of *some* foreign computers on order (and this is known not to be complete) shows an order book of nearly 8,500 computers of an estimated value of about $3,000,000,000.

As opposed to the 259 computers installed in Britain there are installed abroad, 80 British computers of a value of something like $11,000,000 and these 80 represent our contribution to a world wide installation of computers amounting to nearly 7,500.

The British computer manufacturers have in the past criticized the lack of enterprise in Britain to make use of computers. Foreign users are more than half way in their planning to use 16,000 computers. Why have we not been able to obtain even 100 orders from among this large number? Particularly when our computers are on the average lower priced machines. Americans are now selling us the type of machines we could not sell ourselves, let alone them.

These figures speak for themselves, and even after making allowances for differences in population and outlook it makes a sad story in a field we could and should dominate.

NEWS FROM ABROAD

The recently formed European Computer Manufacturers' Assoc. (ECMA) (see DATAMATION, p. 29, August) is well underway in organizing working committees for standardization of character codes and languages. The group's president, C. G. Holland-Martin of ICT, told DATAMATION that one of the prime motivations for forming ECMA was the fear that U.S. manufacturers would secure the adoption of their standards overseas. . . . Packard Bell of Los Angeles and the Cie des Compteurs SA of France have formed a joint company at Montrouge, Seine. It is capitalized at $200,000 of which Cie des Compteurs will hold 65 per cent. The new firm will benefit from the latter's experience with its 2000 main frame and PB will contribute technical data on the 250.

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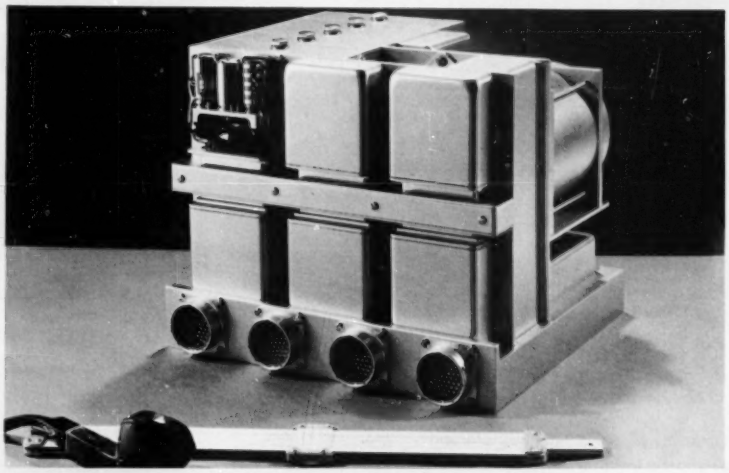
One of the world's smallest digital computers, the L-70, was announced last month by Librascope Division of General Precision Inc., for space-vehicle and satellite flight guidance. The 19 pound L-70 utilizes welded circuitry, and improved cooling provides minimum operating temperatures.

The L-70 features a thin film of helium which is used as a bearing for the rotating drum of the memory. In using this gas, rather than previously used metal bearings, the mechanical wear of a metal suspension system is eliminated and a closer tolerance between the drum and the magnetic devices that record and withdraw data is achieved. The drum, in its original application, has a capacity of 112,000 bits which can be increased if necessary.

In the eight-ounce output module used in the L-70, there is a decrease in the number of component parts over earlier modules, simplification of the gear train, and an increase in thermal efficiency. The module will utilize any size output device, potentiometer, synchro or resolver and has a standard accuracy of 0.1 per cent.

The L-70 measures 8½" x 10" x 8". The entire memory system weighs slightly over 5 lbs. ■

CIRCLE 120 ON READER CARD



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Q.

Barre, his wife, Clara, and their children, David, Edward, and Francis are at home.
It is eight in the evening.

1. If Barre is watching television, so is his wife.
2. Either Edward or Francis, or both, are watching television.
3. Either Clara, or David, but not both, is watching television.
4. Edward and David are either both watching or both not watching television.
5. If Francis is watching television, then Barre and Edward are also watching television.

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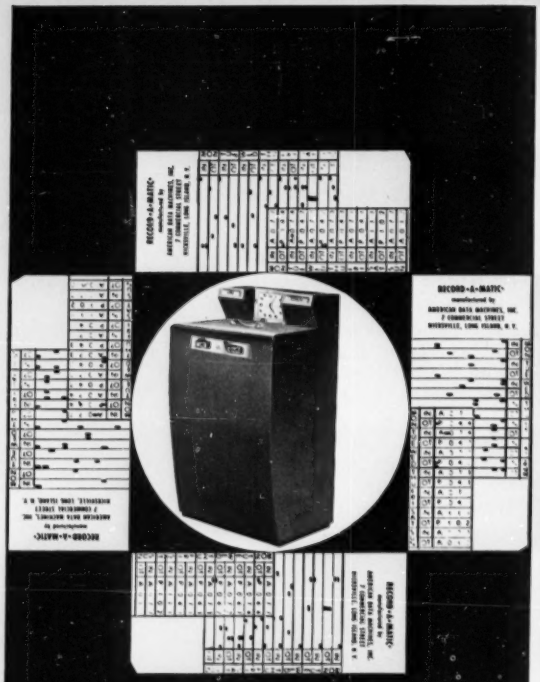

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CIRCLE 52 ON READER CARD

PROJECT LAWSEARCH

a study in disseminable IR

by WILLIAM H. THOMAS, Director,
"Project Lawsearch," Council on Library Resources

Until a few decades ago, the only information retrieval (IR) tools available were classification and alphabetic subject heading systems. They had many drawbacks, but one great advantage; they could be printed in book form and, at very low cost, distributed to tens of thousands of users.

The continued growth and refinement of technology, however, has caused a breakdown of classification and subject heading schemes. One solution to this problem is to index documents by key words or key concepts and enter these key words into a mechanized search system.

"Project Lawsearch" aims to demonstrate the feasibility of a *disseminable* mechanized search system.

In indexing, a document is usually indexed by anywhere from five to thirty key words, freely combinable into search phrases of three to six words each. A number of computers and various other special IR devices based on this technique are on the market.

The law was chosen as a subject for a demonstration project along these lines because it presents a field in which there is a well defined vocabulary of key concepts.

The equipment being used involves superimposable key word cards and was developed by Jonker Business Machines.

By way of example, a search for cases in California relating to baggage falling from a bagggage rack in a bus and injuring a passenger would entail placing the following key concept cards in superimposition upon the readout device: "California," "Baggage," "Falling from or off," "Baggage Rack," "Bus" and "Passenger Injured." If precedent exists, coinciding holes in these cards designate such cases. Reading off of the appropriate cases, as found in the law reports.

The equipment is extremely simple and comparatively inexpensive. Anyone can perform data entry as well as search without previous special training. Ten thousand items can be searched in a fraction of a minute. The main drawback of this "Termatrex" equipment, when used for publication purposes, is the high cost and bulk of the cards. There is also the updating problem.

It is therefore contemplated that when the selected motor carrier cases are fully indexed the data will be transferred to a miniaturized version of the equipment now being built by Jonker under contract with the Council on Library Resources as a companion venture.

This "Mini-matrex" equipment provides for photographic miniaturization of the cards to about one-tenth of their original size. This will call for optical enlargement, with consequent increase in initial cost, but the cost and bulk of the cards are proportionately reduced. In fact, the cards become a throwaway item, thereby solving the updating problem. Additionally, the reduction in bulk permits substantially greater capacity.

This will necessarily involve conventional punch card systems and computers as well as the automatic transfer of index data from these systems into Termatrex and Mini-matrex systems.

This takes cognizance of two seemingly conflicting schools of thought. The first of these favors the "information center" equipped with large IR computers performing searches for remote subscribers linked to the center by mail, telephone, facsimile or even television. The other school of thought insists that the search must be performed under the control of the user and favors the concept of the disseminable search system.

In reality a marriage between the two may be desirable and entirely possible. ■

Author William H. B. Thomas (left), and Frederick Jonker, of Jonker Business Machines, examine the hardware for the Council on Library Resources' pilot program of mechanized law searching.

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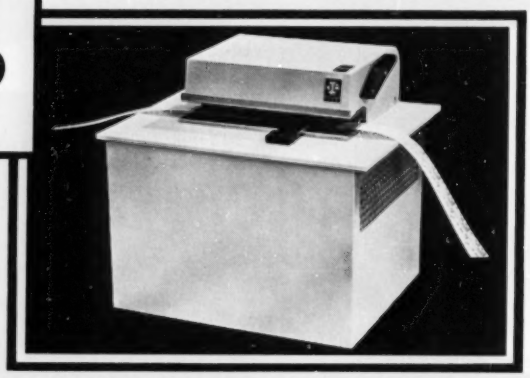

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PERIPHERAL EQUIPMENT: An illustrated, 39-page catalog presents the product line of this company which includes perforators, printers, readers, switching mechanisms, and reperforator-comparators. Company background and a price list are also given. SOROBAN ENGINEERING, INC., Box 1717, Melbourne, Fla. For copy:
CIRCLE 130 ON READER CARD

SORT OPERATIONS: A color brochure on Sort Operations highlights the 2000 system. Examples of speed and capacity of the 2000 are emphasized. PHILCO CORP., COMPUTER DIV., 3900 Welsh Road, Willow Grove, Penna. For copy:
CIRCLE 131 ON READER CARD

LOGICAL TRANSDUCERS: Semiconductor switching phenomena for use in the execution of complex logical operations is investigated in the report, *Solid-State Logical Transducers*, by F. E. Battocletti. Send $1.00 to: OTS, U.S. Dept. of Commerce, Washington 25, D.C.

SYNCHRONOUS TAPE READER: A leaflet surveys the CX 100-character-per-second synchronous tape reader. Application information as well as an illustrated description of parts are included. TELETYPE CORP., 5555 Touhy Ave., Skokie, Ill. For copy:
CIRCLE 132 ON READER CARD

G-20 SYSTEM: A six page brochure highlights the hardware, software and service features of the G-20 system. Each component of the system is described and illustrated. BENDIX COMPUTER DIVISION, 5630 Arbor Vitae St., Los Angeles 45, Calif. For copy:
CIRCLE 133 ON READER CARD

OPTIMIZING PROCESS: *Symbolic Address-Symbolic Optimum Programs For A Drum-Memory Computer*, by J. K. Russell, is a 42-page report which describes a fast optimizing process in which memory locations are imposed on a magnetic drum used for symbolic address optimum data programs. Send $1.25 to: OTS, U.S. Dept. of Commerce, Washington 25, D.C.

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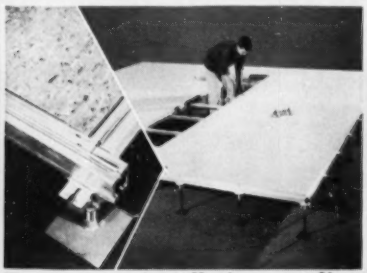

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terrogators and includes such topics as a functional description, interrogator tabulation, station controls, computer control, technical specifications, electrical characteristics and applications. INFORMATION PRODUCTS CORP., 156 6th St., Cambridge, Mass. For copy:

CIRCLE 134 ON READER CARD

B 5000 OPERATING SYSTEM: This 12-page bulletin-*MCP Characteristics*-describes, in general terms, the functions and operation of the Master Control Program incorporated in the Burroughs B 5000. Includes a discussion of overall operating system philosophy; MCP storage and timing requirements, and details of MCP operation-loading, scheduling, and the interrupt system. BURROUGHS CORPORATION, 6071 2nd Avenue, Detroit 32, Michigan. For copy:

CIRCLE 135 ON READER CARD

MICROFILM TELEVISER: An illustrated booklet describes a microfilm televiser with remote positioning and magnification. Features and an example of operation are given. GENERAL PRECISION, INC., GPL DIVISION, Pleasantville, N.Y. For copy:

CIRCLE 136 ON READER CARD

CONTROL PEDESTALS: A brochure describes control pedestals for series 4-

New Literature . . .

1000 high speed line printers. Design, performance characteristics, components and specifications of the pedestals are given. ANELEX CORP., 150 Causeway St., Boston 14, Mass. For copy:

CIRCLE 137 ON READER CARD

VIDEOGRAPH DATA: A six page brochure gives information on videograph data communication systems and includes a description of the various models. A. B. DICK CO., 5700 W. Touhy Ave., Chicago, Ill. For copy:

CIRCLE 138 ON READER CARD

MICROSADIC: A 16-page booklet highlights the MicroSADIC digital data acquisition system and gives a description of the major components as well as detailed system specifications. CONSOLIDATED ELECTRODYNAMICS CORP., 360 Sierra Madre Villa, Pasadena, Calif. For copy:

CIRCLE 139 ON READER CARD

DIRECT VIEW DISPLAY: This booklet describes the S-C 1090 direct view display, and gives examples of how it may be used for various applications. Diagrams, modular options, operating principles and characteristics are provided. GENERAL DYNAMICS/ELECTRONICS, INFORMATION TECHNOLOGY DIV., 1895 Hancock St., San Diego, Calif. For copy.

CIRCLE 140 ON READER CARD

DIGITAL CIRCUITRY: "Digital Application Notes" is a 68-page handbook that covers digital circuitry applications and includes chapters on basic logic design principles, graphic symbols, logic modules and circuit configurations. Diagrams and an explanation of Boolean algebra are also given. INTERSTATE ELECTRONICS CORP., 707 E. Vermont Ave., Anaheim, Calif. For copy:

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MICROFILM SYSTEM: An illustrated leaflet presents an engineering data microfilm system and describes electronic telephone communications which automatically activate a quick access file of "filmsort" aperture cards, duplication of the cards, microfilm mounting, and data print-out. MINNESOTA MINING & MFG. CO., 900 Bush Ave., St. Paul 6, Minn. For copy:

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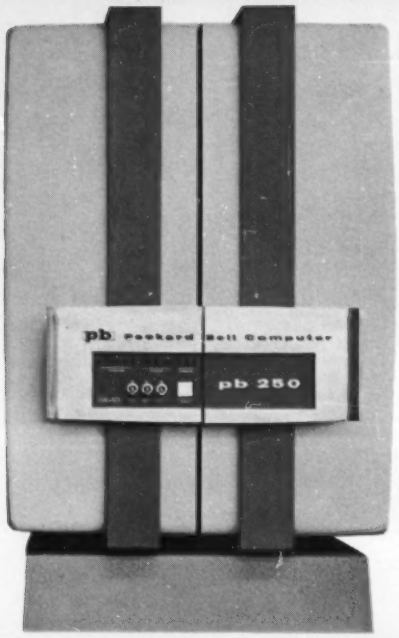

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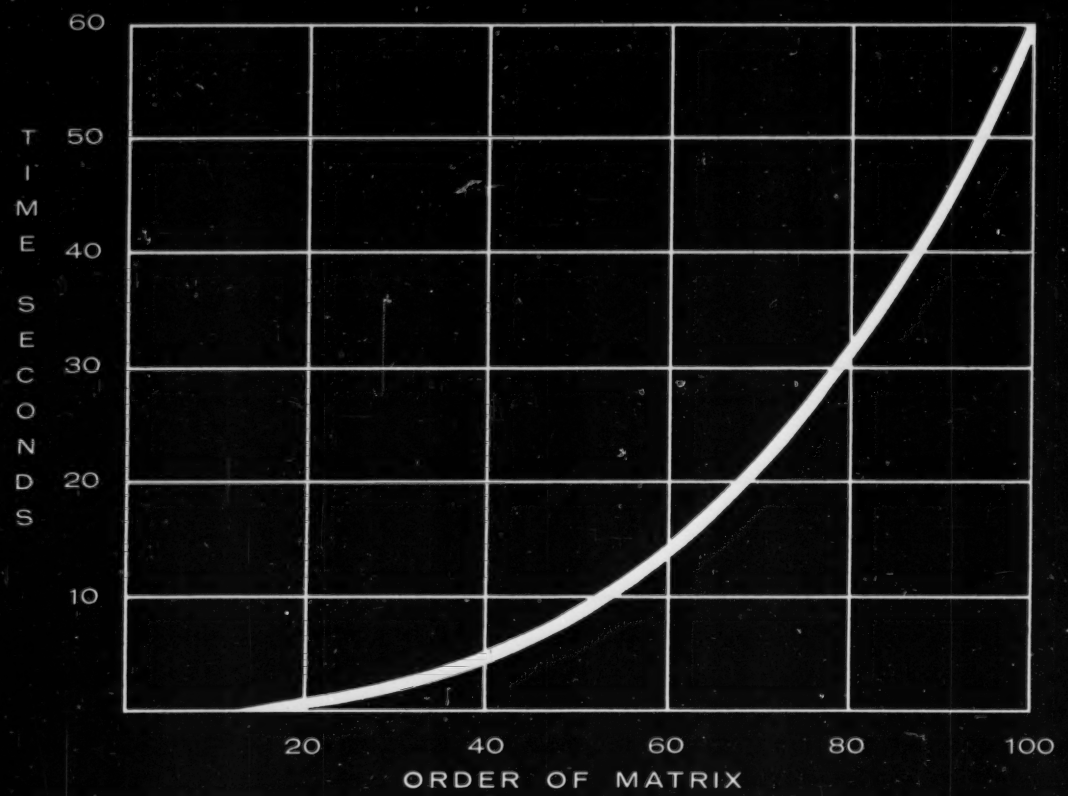

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